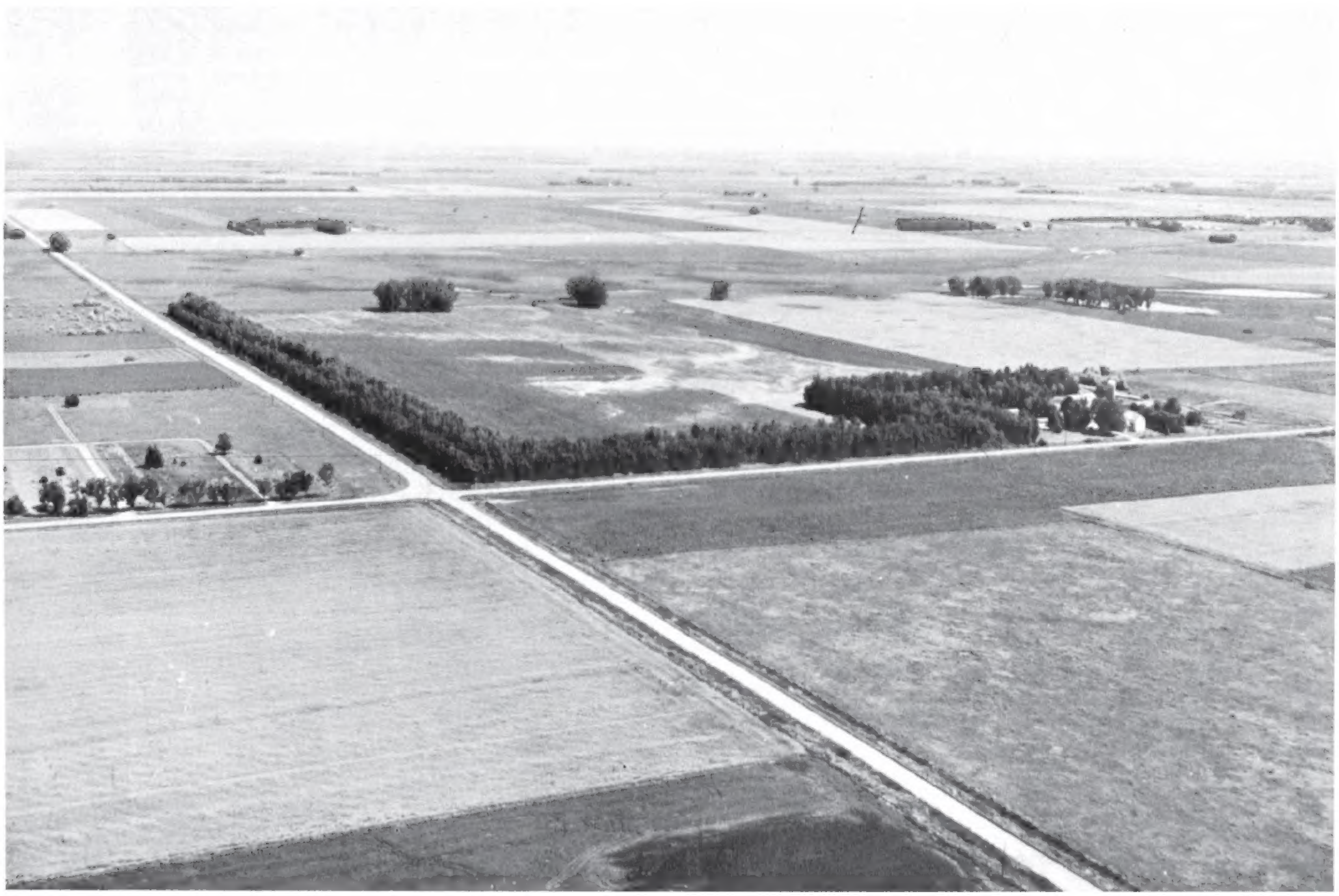
SOIL SURVEY OF

Davison County, South Dakota



United States Department of Agriculture
Soil Conservation Service
In cooperation with
South Dakota Agricultural Experiment Station

Issued January 1974

Major fieldwork for this soil survey was done in the period 1958–64. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1966. This survey was made cooperatively by the Soil Conservation Service and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Davison County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Davison County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the pasture group and windbreak group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, pasture groups, and windbreak groups.

Foresters and others can refer to the section "Use of the Soils for Windbreaks," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial and light industrial buildings and for recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers to Davison County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County" and at the beginning of the publication.

Cover: **Windbreaks on soils of association 4 help to control soil blowing, and they protect the farmstead from wind.**

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Issued January 1974

SOIL SURVEY OF DAVISON COUNTY, SOUTH DAKOTA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

DAVISON COUNTY is in the southeastern part of South Dakota (fig. 1). Its total area is 277,120 acres, or about 433 square miles. Mitchell is the county seat and is the largest city in the county.

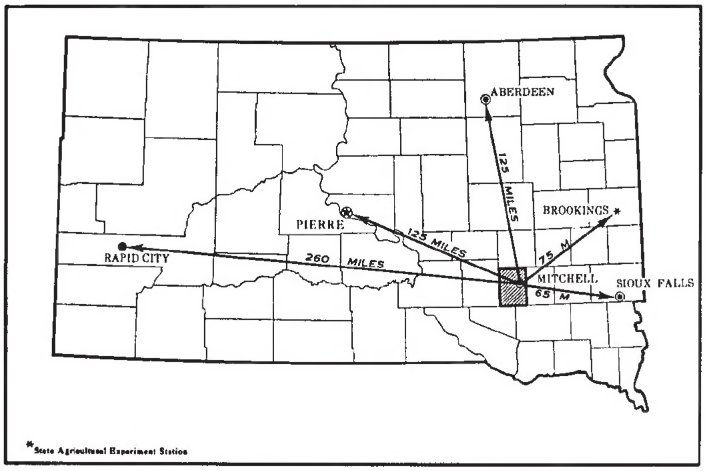

Figure 1.—Location of Davison County in South Dakota.

Davison County is relatively flat, with only 440 feet difference in elevation from the highest point of 1,665 feet above sea level in the southwestern part of the county to the lowest point of 1,225 feet in the northeastern corner of the county. Large, flat glacial ground moraines characterize the western, south-central, and east-central parts of the county where only minor local relief, measured in 1- to 5-foot increments, and many undrained depressions and ill-defined drainageways break the monotony of the landscape. The central and southeastern parts of the county have many gently undulating minor glacial moraines. The northeastern part of the county is relatively flat, but is dissected by the steep river breaks and flat bottom lands of the James River.

The James River enters the county in the northeastern corner, flows in a southerly direction, and leaves the county about 3 miles east of Mitchell.

Major tributaries to the James River flowing through Davison County are Firesteel Creek that drains the northern part of the county, Enemy Creek that drains the central part, and Twelve Mile Creek that drains the southern part. These streams generally flow in a west to east direction.

Farming is the main source of income in the county. Corn, oats, grain sorghum, forage sorghum, alfalfa, and tame grasses are the main crops. These crops are vital to the extensive livestock raising operations. The chief concerns of management on cultivated soils are conservation of moisture, control of water erosion and soil blowing, and the maintenance or improvement of tilth, content of organic matter, and fertility.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Davison County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Houdek and Ethan, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic

that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Redstoe loam, 0 to 3 percent slopes, is one of several phases within the Redstoe series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Davison County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Betts-Ethan loams, 6 to 21 percent slopes.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Betts and Ethan loams, 21 to 40 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Alluvial land is a land type in Davison County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Davison County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The seven soil associations in Davison County are discussed in the following pages. The terms for texture used in the titles of the associations apply to the surface layer. For example, in the title for association 1, the word "loamy" refers to texture of the surface layer.

1. Enet-Delmont Association

Nearly level to gently undulating, well-drained to somewhat excessively drained, loamy soils that formed in alluvium over sand and gravel on terraces and uplands

This association is on high terraces along Firesteel Creek and on uplands in the southeastern part of the county. The nearly level areas are interspersed with rounded ridges and narrow ill-defined drainageways. Slopes are short and convex in the gently undulating parts of the association.

This association makes up about 7 percent of the county. It is about 65 percent Enet soils, 12 percent Delmont soils, and 23 percent minor soils.

The Enet soils are well drained and nearly level. They are on the lower parts of side slopes. Enet soils have a surface layer of very dark gray loam and a subsoil that is very dark gray loam in the upper part and dark grayish-brown sandy loam in the lower part. Light brownish-gray and pale-brown gravelly loamy sand is at a depth

of about 24 inches and is underlain by multicolored sand and gravel at a depth of about 32 inches.

Delmont soils are on narrow ridges and swells and are somewhat excessively drained. They have a very dark gray loam surface layer and a subsoil of very dark grayish-brown loam. Gravel and sand are at a depth of about 15 inches.

A minor part of the association consists of Davison, Fedora, and Storla soils in low areas and along drainageways and Blendon and Hand soils on slight rises. The Davison, Fedora, and Storla soils are high in content of lime and are moderately well drained or somewhat poorly drained.

Most areas are cultivated. Corn, oats, grain sorghum, alfalfa, and tame grasses are the main crops. The soils are better suited to grain sorghum, small grains, and tame grasses than to deep-rooted crops. They are droughty and are medium to low in fertility. Crops grown on these soils respond well to irrigation, although available water capacity is low. The main concerns of management are conservation of moisture and the control of water erosion and soil blowing.

2. Blendon-Hand Association

Nearly level to gently undulating, well-drained, loamy soils that formed in sandy and loamy glacial outwash on uplands

This association is in the northeastern part of the county. The area consists of two distinct levels of glacial terraces separated by a gently undulating terrace front. The nearly level terrace-like areas are interspersed with low, convex-shaped rises and ill-defined drainageways. Slopes are short and convex on the terrace fronts.

This association makes up about 2 percent of the county. It is about 50 percent Blendon soils, 30 percent Hand soils, and 20 percent minor soils.

Blendon soils are on the lower level of the association. They have a very dark gray, sandy loam surface layer and a subsoil of dark grayish-brown sandy loam. The underlying material is brown loamy fine sand.

Hand soils are on the upper level of the association. They have a dark-gray surface layer and a subsoil of grayish-brown loam that is calcareous in the lower part. Below the subsoil is calcareous clay loam and loamy fine sand.

Less extensive in the association are the Davison, Fedora, and Storea soils along drainageways and in low areas and swales, and Enet soils in scattered areas where gravel and sand are at a moderate depth. Davison, Fedora, and Storla soils are high in lime content and are moderately well drained or somewhat poorly drained.

Most areas are cultivated. Corn, small grains, sorghum, alfalfa, and tame grasses are suitable crops. Soils of this association are somewhat droughty. Blendon and Hand soils have few limitations for irrigation. Controlling soil blowing and conserving moisture are the main management needs. Controlling water erosion on the gently undulating soils in the association is also a concern of management.

3. Houdek-Stickney Association

Nearly level, well drained and moderately well drained, loamy soils that formed in glacial till on uplands

Areas of this association are broad and nearly level and are mainly in the southwestern part of the county. Local relief is minor and consists of very slight rises and ill-defined drainageways that terminate in a few closed depressions (fig. 2).

This association makes up about 9 percent of the county. It is about 40 percent Houdek soils, 30 percent Stickney soils, and 30 percent minor soils.

The well-drained Houdek soils are on very slight rises. They have a dark grayish-brown loam surface layer and a subsoil that is dark grayish-brown and grayish-brown clay loam. The lower part of the subsoil is light olive brown, and it is calcareous. The underlying material is calcareous light yellowish-brown clay loam.

Stickney soils are in the lower and nearly flat areas and slopes are plane or concave. The soils have a dark-gray loam surface layer and a very dark grayish-brown to grayish-brown clay loam subsoil. The underlying material is calcareous clay loam. Stickney soils are moderately well drained, and they have slow permeability.

The most extensive minor soils are those of the Beadle series. They have a more clayey subsoil than the Houdek soils. Other minor soils include Dudley soils intermingled with Stickney soils; Prosper soils in narrow swales and drainageways; and Tetonka soils in low spots and in closed depressions.

Most of this association is cultivated. Corn, small grains, sorghums, alfalfa, and tame grasses are the crops grown. Stickney soils are less well suited to corn than Houdek soils. Conserving moisture is the main management need. Improving tilth is a concern of management on areas of Stickney soils.

4. Houdek-Prosper-Tetonka Association

Nearly level, well drained and moderately well drained, loamy soils that formed in glacial till and somewhat poorly drained silty soils on uplands

Areas of this association are scattered throughout the county. The nearly level areas consist of slight rises and narrow swales and drainageways that terminate in numerous small depressions that dot the landscape (see fig. 2).

This association makes up about 29 percent of the county. About 50 percent is Houdek soils, 20 percent Prosper soils, 10 percent Tetonka soils, and about 20 percent minor soils.

The well-drained Houdek soils are on slight rises. They have a dark grayish-brown loam surface layer and a subsoil of dark grayish-brown and grayish-brown clay loam that becomes light olive brown and calcareous in the lower part. The underlying material is calcareous light yellowish-brown clay loam.

Prosper soils are in swales and on the lower parts of slight rises. They have a dark-gray loam surface layer and a dark-gray clay loam subsoil that is light brownish-gray and calcareous in the lower part. Prosper soils have thicker surface and subsoil layers than Houdek soils and are moderately well drained.

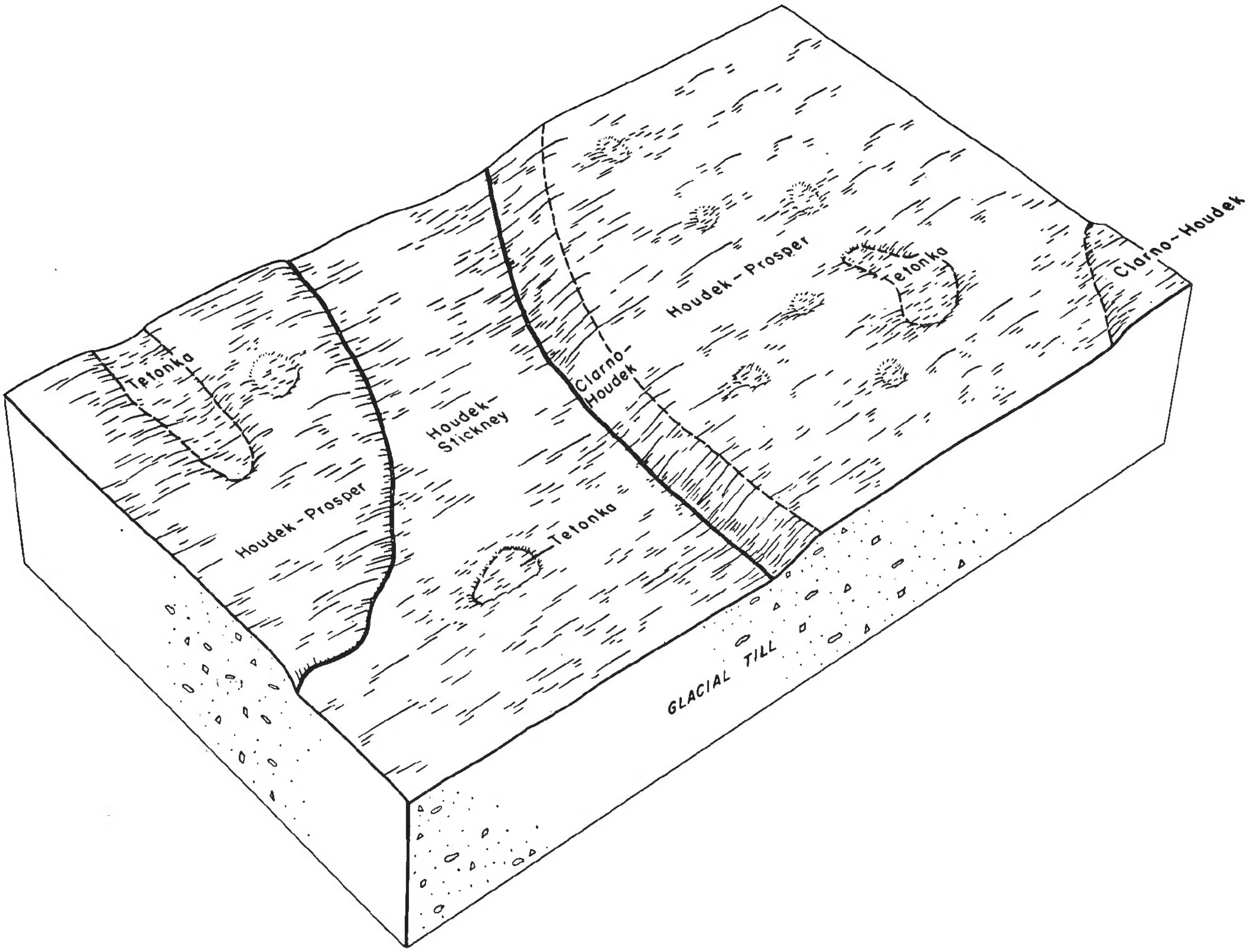

Figure 2.—**Typical pattern of Houdek and Stickney soils in association 3 and of Houdek, Prosper, and Tetonka in association 4.**

Tetonka soils are in depressions and are somewhat poorly drained. They have dark-gray surface and gray subsurface layers of silt loam. The subsoil is dark-gray clay in the upper part and gray and light olive-gray clay loam in the lower part. Light-gray calcareous clay loam is at a depth of 56 inches. Runoff water ponds on the Tetonka soils, which have slow permeability.

Less extensive soils in the association are Clarno and Ethan soils on narrow ridges and knolls, and Stickney soils in the lower and nearly level areas.

Most of this association is cultivated except for a few areas of Tetonka soils in the larger depressions. These areas are used for grazing and as wildlife habitat. Corn, small grains, sorghums, alfalfa, and tame grasses are the main crops. Unless adequately drained, the Tetonka soils are better suited to hay and grazing than to cultivated crops. Conserving moisture is the main concern of management on the Houdek and Prosper soils. Improving drainage and tilth is a concern of management on the Tetonka soils.

5. Clarno-Houdek-Betts Association

Nearly level to steep, well-drained to excessively drained, loamy soils that formed in glacial till on uplands

Areas of this association are in all parts of the county. The nearly level to undulating relief of the larger areas typically consists of short, convex, irregular slopes separated by swales and drainageways. Smaller areas that are rolling to steep (fig. 3) are near the James River and its main tributaries. In the latter areas the convex slopes are distinctly cut by drainageways.

This association makes up about 46 percent of the county. It is about 30 percent Clarno soils, 20 percent Houdek soils, and 5 percent Betts soils. The remaining 45 percent is minor soils.

The well-drained Clarno soils have a surface layer of dark-gray loam and a subsoil of grayish-brown loam. The lower part of the subsoil, and the underlying material, are calcareous and light yellowish brown. The underlying material is clay loam. Clarno soils have convex slopes.

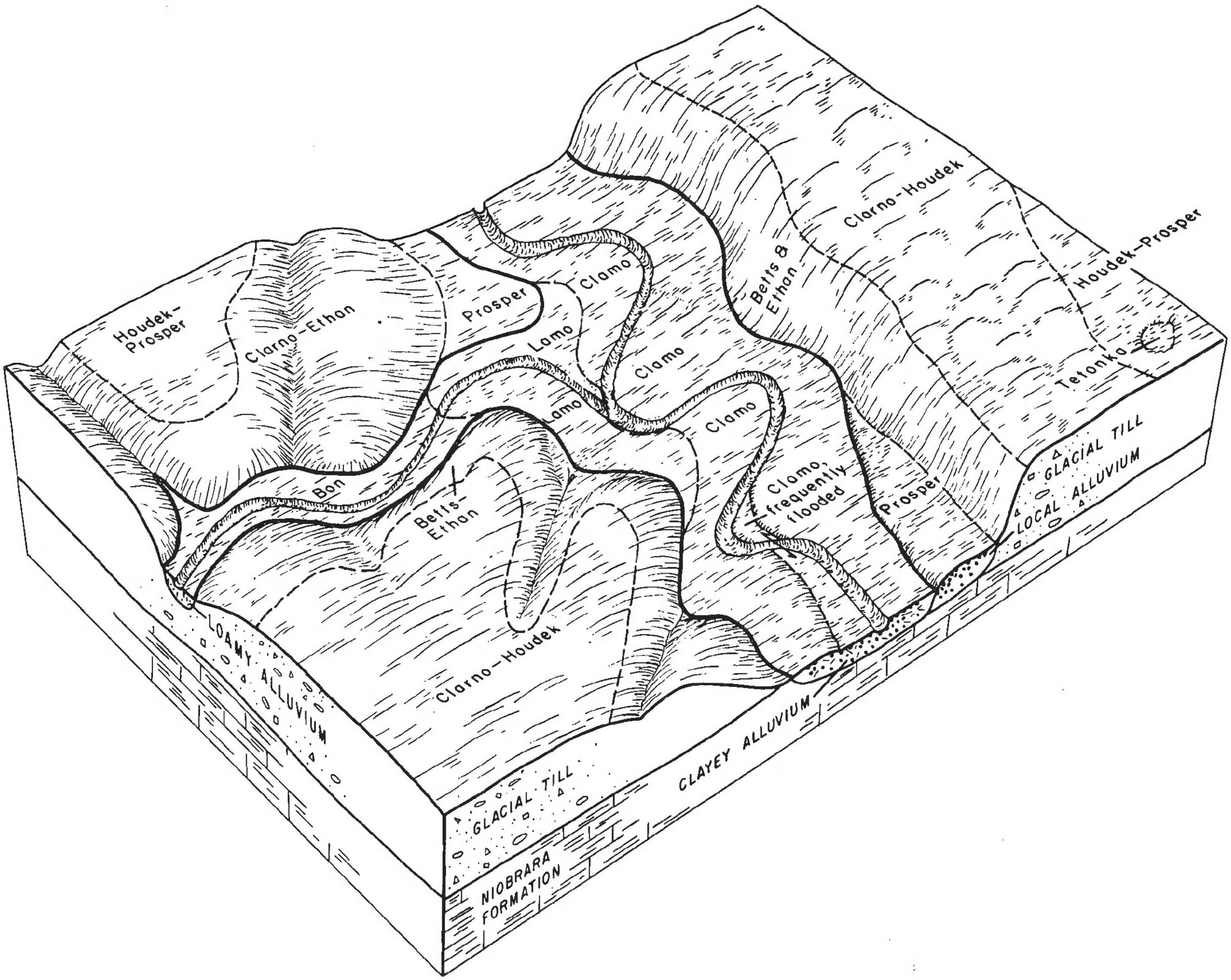

Figure 3.—**Typical pattern of soils of associations 5 and 7 near the James River and Firesteel Creek.**

The well-drained Houdek soils have a surface layer of dark grayish-brown loam. The subsoil is clay loam that is dark grayish brown and grayish brown in the upper and middle parts. The lower part is light olive brown and is calcareous. The underlying material is calcareous light yellowish-brown clay loam. These soils are in the more nearly level parts of the association.

The excessively drained Betts soils have a thin surface layer of calcareous dark grayish-brown loam and a thin subsoil of calcareous grayish-brown loam. The underlying material at a depth of about 8 inches is calcareous light brownish-gray clay loam. Betts soils are on the upper parts of convex slopes and on ridgetops.

Less extensive areas in this association are occupied by Lamo and Salmo soils and Alluvial land on narrow bottom lands; by Enet soils in areas where gravel is at a depth of less than 40 inches; by Ethan soils on convex slopes and on the wider crests of slopes; by Prosper soils in swales and on footslopes; and by Tetonka soils in slightly depressed areas and in closed depressions.

Most of this association is cultivated. Corn, sorghum, small grains, alfalfa, and tame grasses are the main crops. Rolling to steep areas along the James River and its tributaries are in native grasses and are used for grazing. Some of the more poorly drained soils on bottom lands and in depressions are used for grazing and hay and as wildlife habitat. The main concerns of management are controlling water erosion and soil blowing, conserving moisture, and maintaining fertility and organic-matter content.

Use of terraces, waterways, and contour farming is difficult in many of the undulating areas because of the short irregular slopes.

6. Redstoe-Firesteel Association

Nearly level to hilly, well-drained to somewhat poorly drained, calcareous, loamy and silty soils over siltstone on uplands

Areas of this soil association are mainly along Enemy and Firesteel Creeks. They consist of nearly level terraces with little or no local relief, nearly level to undulating uplands, and rolling to hilly slopes adjacent to streams. Outcrops of very pale brown to white siltstone in the hilly areas help to identify the areas.

This association makes up about 4 percent of the county. It is about 30 percent Redstoe soils, 20 percent Firesteel soils, and 50 percent other soils.

The well-drainod Redstoe soils have plane to convex slopes in all parts of the association. Slopes are short and irregular. Redstoe soils have a surface layer of very dark grayish-brown and grayish-brown loam and a subsoil of pale-brown silt loam. The underlying material is very pale brown and light yellowish-brown silt loam. Very pale brown siltstone is at a depth of 32 inches.

The moderately well drained to somewhat poorly drained Firesteel soils are on terraces and in slightly depressed areas on uplands. A seasonal water table rises to within 3 feet of the surface early in the growing season. Firesteel soils have a gray silt loam surface layer over a transitional layer of gray and light-gray silt loam. Below this layer is white silt loam. White bedded siltstone is at a depth of about 30 inches.

Among the other soils, the poorly drained Salmo soils are the most extensive and make up about 15 percent of the association. They are on narrow bottom lands. Less extensive are Alluvial land on narrow bottom lands; Betts and Gavins soils in hilly to steep areas; Clarno and Ethan soils in areas where glacial till overlies the siltstone; and Blendon, Enet, and Storla soils on some of the terraces.

Much of this association is in native grasses or is seeded to tame grasses and is used for grazing and hay. Many areas of nearly level to undulating Redstoe soils are cultivated. Crop growth is affected by the high content of lime and low fertility. Concerns of management include the improvement of organic-matter content and fertility and the control of water erosion and soil blowing.

7. Clamo-Lamo-Bon Association

Nearly level, moderately well drained to poorly drained, silty and loamy soils that formed in alluvium on bottom lands

Areas of this association are on bottom lands along the James River and Firesteel Creek. Meandering stream channels (fig. 3) dissect the nearly level flood plains into small tracts on either side of the channel. Partly filled old channels and short riser-steps between the various levels of the stream valley account for the main differences in relief.

This association makes up about 3 percent of the county. It is about 30 percent Clamo soils, 20 percent Lamo soils, 15 percent Bon soils, and about 35 percent minor soils.

The poorly drained Clamo soils are on the main flood plain of the James River. They have a dark-gray silty clay loam surface layer and a subsoil of gray and grayish-brown silty clay.

The somewhat poorly drained Lamo soils commonly are on the flood plains of Firesteel Creek. They have a surface layer of calcareous dark-gray silt loam over a transitional layer of gray silt loam. The underlying material is calcareous gray silty clay loam.

The moderately well drained Bon soils are on the bottom lands of Firesteel Creek at slightly higher levels than Lamo soils. Bon soils have a thick very dark gray and very dark grayish-brown loam surface layer. The underlying material is stratified calcareous fine sandy loam and loamy fine sand.

Less extensive soils are Alluvial land in low areas along the stream channels, Prosper soils on foot slopes of adjacent steep soils on the outer edges of the valleys, and Salmo soils in low areas near Lamo soils.

Many of the larger well-drained areas are cultivated. Alfalfa, corn, and sorghums are better suited than early-sown crops on Clamo and Lamo soils. The less well drained areas are in native vegetation and are used for grazing and hay and as wildlife habitat. The main management concerns on Clamo and Lamo soils are control of excess water, improvement of tilth, and maintenance of organic-matter content and fertility . Conserving moisture is the main management concern on Bon soils.

Descriptions of the Soils

This section describes the soil series and mapping units in Davison County. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of the soil series. Alluvial land, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, pasture group, and windbreak group in which the mapping unit has been placed. The page for the description

of each capability unit, pasture group, and windbreak group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (7).[1]

A given soil series in this county may be identified by a different name in a recently published soil survey of an adjacent county. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil series described in this county are considered to be within the range defined for that series. Where a soil series has one or more features outside the defined range, the differences are explained.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Alluvial land	4, 900	1. 8
Beadle loam, 0 to 2 percent slopes	4, 100	1. 5
Betts and Ethan loams, 21 to 40 percent slopes	6, 339	2. 3
Betts-Ethan loams, 6 to 21 percent slopes	3, 637	1. 3
Betts-Gavins complex, 15 to 40 percent slopes	1, 000	. 4
Blendon sandy loam, 0 to 3 percent slopes	5, 766	2. 1
Blendon-Firesteel complex, 0 to 3 percent slopes	1, 000	. 4
Bon loam, 0 to 2 percent slopes	1, 406	. 5
Clamo silty clay loam	2, 545	. 9
Clamo silty clay loam, frequently flooded	487	. 2
Clarno-Ethan loams, 3 to 6 percent slopes	8, 534	3. 1
Clarno-Ethan loams, 6 to 9 percent slopes	6, 600	2. 4
Clarno-Houdek loams, 0 to 3 percent slopes	35, 900	13. 0
Clarno-Houdek loams, 3 to 6 percent slopes	29, 666	10. 7
Davison-Hand loams, 0 to 2 percent slopes	1, 122	. 4
Delmont loam, 3 to 6 percent slopes	1, 172	. 4
Enet loam, 0 to 3 percent slopes	11, 900	4. 3
Enet-Delmont loams, 0 to 3 percent slopes	1, 400	. 5
Enet-Delmont loams, 3 to 6 percent slopes	1, 189	. 4
Enet-Storla loams, 0 to 2 percent slopes	655	. 2
Ethan-Betts loams, 5 to 9 percent slopes, eroded	2, 100	. 8
Fedora sandy loam, 0 to 3 percent slopes	900	. 3
Firesteel silt loam, 0 to 2 percent slopes	1, 724	. 6
Hand loam, 3 to 6 percent slopes	225	. 1
Hand-Davison loams, 0 to 3 percent slopes	2, 700	1. 0
Houdek-Prosper loams, 0 to 2 percent slopes	67, 611	24. 4
Houdek, Prosper and Stickney loams, 0 to 1 percent slopes	11, 400	4. 1
Houdek-Stickney loams, 0 to 2 percent slopes	21, 300	7. 7
Lamo silt loam	3, 172	1. 1
Lamo and Prosper soils, 0 to 3 percent slopes	1, 800	. 7
Prosper silt loam, 0 to 3 percent slopes	1, 600	. 6
Prosper silt loam, 3 to 6 percent slopes	800	. 3
Redstoe loam, 0 to 3 percent slopes	1, 100	. 4
Redstoe loam, 3 to 9 percent slopes	1, 138	. 4
Redstoe loam, 9 to 21 percent slopes	421	. 1
Salmo silt loam	4, 176	1. 5
Stickney-Dudley complex, 0 to 2 percent slopes	5, 200	1. 9
Storla loam, 0 to 2 percent slopes	1, 977	. 7
Storla complex, 0 to 2 percent slopes	1, 100	. 4
Tetonka silt loam, 0 to 2 percent slopes	14, 748	5. 3
Tetonka-Stickney complex, 0 to 3 percent slopes	1, 400	. 5
Gravel pits	340	. 1
Water (area less than 40 acres in size)	422	. 1
Water (area more than 40 acres in size)	448	. 1
Total	277, 120	100. 0

[1] Italic numbers in parentheses refer to Literature Cited, p. 68.

Alluvial Land

Alluvial land (0 to 2 percent slopes) (Aa) is on low, frequently flooded bottom lands in all parts of the county. Meandering channels cut the areas into small, isolated tracts. Alluvial land is made up of soils formed in alluvium. The texture commonly is loam, but it ranges from loamy sand to clay. The underlying alluvium generally is layered with material of contrasting texture. A fluctuating water table is present in many areas.

Included with this land type in mapping are small areas of Bon, Clamo, Lamo, and Salmo soils.

Alluvial land is mostly in native vegetation of tall and mid grasses and deciduous trees and shrubs. Intensive farming is not practical in many places, because of the irregular shape and size of the areas and because of the hazard of flooding. Some of the larger tracts have been cleared. Cleared areas are used for hay, but they are well suited to alfalfa and tame grasses. Capability unit VIw-1; pasture group B; windbreak group 2.

Beadle Series

The Beadle series consists of deep, well-drained, nearly level soils that are loamy. These soils formed in glacial till and are on uplands.

In a representative profile the surface layer is dark-gray loam about 5 inches thick. The subsoil is about 25 inches thick. It is clay loam that is dark brown in the upper part, dark grayish brown in the middle part, and light brownish-gray in the lower part. It is hard when dry and firm when moist. The lower part is calcareous, and it contains many spots of soft lime that extend into the underlying material. The underlying material is calcareous, pale-olive clay loam.

Beadle soils are medium in fertility and are moderate in content of organic matter. Runoff is slow, and permeability is moderately slow. Available water capacity is high.

Most areas are cultivated. Corn, grain sorghums, small grains, alfalfa, and tame grasses are the main crops. A few areas are in native grass. Native grasses include green needlegrass, western wheatgrass, and blue grama.

Representative profile of Beadle loam, 0 to 2 percent slopes, in alfalfa, 225 feet north and 85 feet east of the SW. corner of sec. 6, T. 102 N., R. 62 W.:

Ap—0 to 5 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) when moist; weak, thin, platy structure that parts to weak, fine, granular; soft, very friable; slightly acid; abrupt, smooth boundary.

B21t—5 to 10 inches, dark-brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) when moist; black stains of organic matter on faces of peds; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, slightly sticky and slightly plastic; thin, continuous clay films on vertical faces of peds; neutral; clear, smooth boundary.

B22t—10 to 15 inches, dark-brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) when moist; moder-

ate, coarse and medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, slightly sticky and slightly plastic; moderately thick, continuous clay films on all faces of peds; mildly alkaline; clear, smooth boundary.

B23t—15 to 19 inches, dark grayish-brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and plastic; moderately thick, continuous clay films on all faces of peds; mildly alkaline; abrupt, irregular boundary.

B3ca—19 to 30 inches, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, slightly sticky and slightly plastic; thin, patchy clay films on vertical faces of peds; many, medium and coarse, prominent segregations of lime; calcareous; moderately alkaline; gradual, irregular boundary.

C1ca—30 to 50 inches, pale-olive (5Y 6/3) clay loam, olive (5Y 4/3) when moist; common, fine, distinct, gray mottles and a few, fine, faint, brownish-yellow mottles; massive; slightly hard, firm, slightly sticky and slightly plastic; common, medium, distinct segregations of lime; calcareous; strongly alkaline; diffuse, irregular boundary.

C2—50 to 66 inches, pale-olive (5Y 6/3) clay loam, olive (5Y 5/3) when moist; common, fine and medium, distinct, gray mottles and a few, fine, faint, brownish-gray mottles; massive; slightly hard, firm, slightly sticky and slightly plastic; common, distinct gypsum crystals; calcareous; moderately alkaline.

The A horizon ranges from 5 to 8 inches in thickness and from dark gray to dark grayish brown in color. In places it is clay loam. The B2t horizons range from 10 to 15 inches in combined thickness and are clay loam or clay in texture. Grade of structure in the B2t horizons is moderate or strong. The B3ca horizon ranges from 8 to 15 inches in thickness. The C horizons range from pale olive to dark grayish brown in color and have friable to very firm consistence when moist. They commonly contain fine fragments of shale and a few pebbles.

Beadle soils contain more clay in the B horizons than the nearby Clarno, Houdek, and Prosper soils. In addition, they have a thinner A horizon and are better drained than the Prosper soils.

Beadle loam, 0 to 2 percent slopes (BaA).—This is the only Beadle soil mapped in the county. It is on uplands in the west-central part of the county. Slopes are long and smooth.

Included with this soil in mapping are areas of Dudley, Prosper, and Stickney soils in slightly depressed areas and along drainageways. These inclusions make up less than 15 percent of the mapped areas.

Most of this soil is farmed. Corn, small grains, sorghums, alfalfa, and tame grasses are suitable crops. The main concerns of management are improving tilth and maintaining the content of organic matter and fertility. Capability unit IIs-1; pasture group E; windbreak group 4.

Betts Series

The Betts series consists of deep, excessively drained, undulating to steep, calcareous, loamy soils that have a thin surface layer (fig. 4). These soils formed in glacial till and are on uplands.

In a representative profile the surface layer is dark grayish-brown loam about 4 inches thick. The subsoil is grayish-brown loam about 4 inches thick. It is slightly hard when dry and friable when moist. The underlying material is light brownish-gray clay loam. It contains spots and masses of lime.

Betts soils are low in fertility and in content of organic matter. Runoff is rapid, and permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. Water erosion is a hazard.

Most areas are in native grasses and are used for grazing. Native grasses include needle-and-thread, little bluestem, side-oats grama, blue grama, and buffalograss. Small areas of Betts soils that occur with Clarno and Ethan soils are cultivated.

Representative profile of Betts loam in an area of Betts and Ethan loams, 21 to 40 percent slopes, in a native grass pasture, 1,545 feet east and 880 feet south of the NW. corner of sec. 22, T. 104 N., R. 60 W.:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable; calcareous; moderately alkaline; clear, wavy boundary.

B2—4 to 8 inches, grayish-brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium and coarse, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, very friable; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—8 to 30 inches, light brownish-gray (2.5Y 6/3) clay loam, dark grayish brown (2.5Y 4/2) when moist; a few, fine, faint mottles of very dark grayish brown and dark brown; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many, medium and coarse masses of segregated lime; calcareous; moderately alkaline; gradual boundary.

C2—30 to 55 inches, light brownish-gray (2.5Y 6/3) clay loam, grayish-brown (2.5Y 5/3) when moist; a few, fine, faint, olive-yellow mottles; massive; hard, friable, slightly sticky and slightly plastic; common, medium and coarse masses of segregated lime; calcareous; moderately alkaline; gradual boundary.

C3—55 to 66 inches, light brownish-gray (2.5Y 6/3) clay loam, grayish brown (2.5Y 5/3) when moist; common, medium, faint, gray and olive-yellow mottles; massive; hard, friable, slightly sticky and slightly plastic; a few, fine and medium gypsum crystals; a few, medium masses of segregated lime; calcareous; moderately alkaline.

The A horizon ranges from 2 to 5 inches in thickness and from very dark grayish brown to gray in color. In cultivated areas, the color of the Ap horizon ranges from light brownish gray to pale brown. The B2 horizon commonly ranges from 3 to 6 inches in thickness, but it is absent in places. The C1ca horizon ranges from 15 to 30 inches in thickness and has a few to many segregations of lime. The C horizons range from loam to clay loam in texture, and commonly contain fine fragments of shale and a few rounded pebbles and cobblestones. In places some granitic stones and cobblestones are at the surface.

Betts soils have thinner A and B horizons than the nearby Ethan soils. They are less silty than the nearby Gavins soils, which are shallow to bedded siltstone.

Betts and Ethan loams, 21 to 40 percent slopes (BeE).—These soils occur as river breaks along the James River and as glacial end moraines in the east-central part of the county. Slopes are short, convex, and irregular (fig. 5). In places stones are on the surface.

Many areas are made up of about 50 percent Betts soils and about 40 percent Ethan soils. In some areas as much as 70 percent is Betts and only 15 percent is Ethan, and in still other areas Betts soils make up as little as 20 percent and included soils make up from 10 to 40

Figure 4.—**Profile of a Betts loam.**

percent of the unit. Betts soils are on the upper parts of slopes and on ridgetops. Their profile is the one described for the Betts series. Ethan soils are on side slopes. Their surface layer is thinner than the one in the profile described for the Ethan series, and in places the surface layer is calcareous, but the two profiles otherwise are similar.

Included with these soils in mapping are areas of Clarno, Delmont, and Prosper soils. Clarno soils are on the more gentle lower slopes and Prosper soils are in swales and on foot slopes and fans. Small areas of Delmont soils occur where sand and gravel are near the surface.

Most areas are in native grass and are used for grazing. Controlling erosion is the main concern of management. Capability unit VIIe–1; not placed in pasture group; windbreak group 10.

Betts-Ethan loams, 6 to 21 percent slopes (BhD).—Betts soils make up 40 percent of this complex, Ethan soils 30 percent, and other soils 30 percent. Betts soils are on the upper parts of slopes and ridgetops and have a profile similar to that described for the Betts series. Areas of Betts soils that range from 1 to 5 acres in size have stones and boulders on the surface. Ethan soils are on side slopes. Their profile is similar to the one described as representative for the Ethan series, except that the surface layer is thinner in places. This undulating complex is along the James River and its tributaries and also on glacial end moraines throughout the county. Slopes are short and irregular.

Included with these soils in mapping are areas of Clarno and Delmont soils. Clarno soils are on the lower parts of the more gentle side slopes. Delmont soils are on the rounded upper side slopes and are underlain by sand and gravel.

Most areas are in native grasses and are used for pasture and hayland. Controlling erosion is the main concern of management. Capability unit VIe–1; Betts soils are in pasture group G, windbreak group 10; Ethan soils are in pasture group F, windbreak group 10.

Betts-Gavins complex, 15 to 40 percent slopes (BlE).—Betts soils make up 40 percent of this complex, Gavins soils 25 percent, and other soils 35 percent. These soils are on uplands adjacent to Enemy Creek and Firesteel Creek. Slopes are short, convex, and irregular. Betts soils are on the side slopes. They have a profile similar to that described for the series, except that they are underlain by siltstone at a depth of below 40 inches in places. Stones are on the surface of the Betts soils in some areas. Gavins soils are on ridgetops and side slopes where the glacial till is thin or is absent. Their profile is the one described as representative for the Gavins series.

Included with these soils in mapping are areas of Ethan, Firesteel, and Redstoe soils. Ethan and Redstoe soils are on the middle and lower parts of slopes. Firesteel soils are in swales and along drainageways. Small areas of siltstone are exposed on cutbanks in some areas.

Most areas of these soils are in native grasses and are used for grazing. Controlling erosion is the main concern of management. Capability unit VIIe–1; not placed in pasture group; windbreak group 10.

Blendon Series

The Blendon series consists of deep, well-drained, nearly level, loamy soils on uplands. These soils formed in sandy, glacial melt-water deposits.

In a representative profile the surface layer is very dark gray sandy loam about 12 inches thick. The subsoil is dark grayish-brown sandy loam about 24 inches thick. It is soft when dry and very friable when moist. Below the subsoil is a buried soil consisting of dark-gray sandy loam that is about 9 inches thick . The underlying material is brown loamy sand.

Blendon soils are medium in fertility and moderate in content of organic matter. Runoff is slow and permeability is moderately rapid. Available water capacity is moderate. These soils are susceptible to soil blowing.

Most areas are farmed. Corn, small grains, sorghums, alfalfa, and tame grasses are suitable crops. A few areas are in native grasses and are used for pasture and hay. Native grasses include prairie sandreed, needle-and-thread, and blue grams.

Figure 5.—**An area of Betts and Ethan loams, 21 to 40 percent slopes, in native grass.**

Representative profile of Blendon sandy loam, 0 to 3 percent slopes, in a plowed field, 1,660 feet south and 610 feet west of the NE. corner of sec. 14, T. 103 N., R. 60 W.:

Ap—0 to 7 inches, very dark gray (10YR 3/1) sandy loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable; neutral; abrupt, smooth boundary.

A12—7 to 12 inches, very dark gray (10YR 3/1) sandy loam, black (10YR 2/1) when moist; weak, coarse, subangular blocky structure that parts to weak, medium and fine, subangular blocky; soft, very friable; neutral; clear, wavy boundary.

B2—12 to 36 inches, dark grayish-brown (10YR 4/2) sandy loam; very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure that parts to weak, medium and coarse, subangular blocky; soft, very friable; neutral; clear, wavy boundary.

Ab—36 to 45 inches, dark-gray (10YR 4/1) crushing to dark grayish-brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure; slightly hard, very friable; neutral; gradual, wavy boundary.

C—45 to 66 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) when moist; massive; soft, loose; mildly alkaline.

The A horizon ranges from 9 to 16 inches in thickness, from very dark gray to dark grayish brown in color, and from sandy loam to fine sandy loam in texture. The B horizon ranges from 15 to 25 inches in thickness and from weak to moderate prismatic in structure. Reaction of the solum ranges from slightly acid to mildly alkaline. The C horizon ranges from sandy loam to loamy sand, but in places finer textured material is below a depth of 40 inches. In places the lower part of the C horizon is pale brown and contains small amounts of gravel. Buried soils, where present, generally are below a depth of 30 inches.

Blendon soils are more sandy and are better drained than Bon soils, which formed in similar material. They are more sandy than Enet soils, which are also moderately deep over sand and gravel.

Blendon sandy loam, 0 to 3 percent slopes (BmA).—This soil has the profile described as representative for the series. It is on uplands in the northeastern part of the county. Most areas are nearly level, but in places slope is as much as 6 percent. Included are areas where the surface layer is loamy sand. Soil blowing has eroded as much as 25 percent of some areas.

Included with this soil in mapping are areas of Delmont, Enet, and Fedora soils. Delmont and Enet soils are on small rises. Fedora soils are in slightly depressed areas and along drainageways. These inclusions make up about 20 percent of the mapped areas.

Corn, small grains, sorghums, alfalfa, and tame grasses are suitable crops although the soil is somewhat droughty. The main concerns of management are control of soil blowing, conservation of moisture, and maintenance of organic-matter content and fertility. Capability unit IIIe-3; pasture group H; windbreak group 5.

Blendon-Firesteel complex, 0 to 3 percent slopes (BnA).—Blendon soils make up 55 percent of this complex, Firesteel soils 35 percent, and other soils 10 percent. The areas are mainly north of Mount Vernon and west of Mitchell. They consist of meandering drainageways

within which are slightly convex rises. Blendon soils are on the rises. They have a profile similar to the one described as representative for the Blendon series, except that soft siltstone is at a depth of about 40 inches in many places. Firesteel soils are less well drained than Blendon soils. They occupy the lower parts of the mapped areas. In places the surface layer is thinner than that of the soil described as representative for the Firesteel series, but the two profiles otherwise are similar.

Included with these soils in mapping are areas of soils of the Delmont, Redstoe, and Storla series. Delmont and Redstoe soils are on some of the slight rises and humps in the area in place of Blendon. Storla soils are in lower areas with Firesteel soils.

About 50 percent of the acreage is cultivated, and the rest is in native grass. Controlling soil blowing and conserving moisture are the main concerns of management on the Blendon parts of the complex. Improving organic-matter content and fertility are the main concerns of management on the Firesteel parts of the complex. Farming operations are delayed in some years because of the seasonal wetness of Firesteel soils. Blendon soils are in capability unit IIIe-3, pasture group H, and windbreak group 5; Firesteel soils are in capability unit IIIs-3, pasture group F, and windbreak group 2.

Bon Series

The Bon series consists of deep, moderately well drained, nearly level, loamy soils on bottom lands. These soils formed in calcareous, stratified alluvium that washed from the surrounding uplands.

In a representative profile the surface layer is very dark gray and very dark grayish-brown loam about 32 inches thick. Except in the upper 6 inches, the surface layer is calcareous. The underlying material is stratified fine sandy loam and loamy fine sand. It is grayish brown in the upper part, brown in the middle part, and pale brown in the lower part.

Bon soils are high in fertility and content of organic matter. Runoff is slow, and permeability is moderate. These soils receive additional moisture in the form of runoff from adjacent uplands, and they are subject to stream flooding about once every 7 years. The water table generally is below a depth of 5 feet, but in wet years it rises into the lower part of the profile. Available water capacity is moderate to high.

Many areas of these soils are in tame grasses and alfalfa. Corn, oats, and grain sorghum are grown on the larger tracts. Narrow irregularly shaped areas are in native grass and are used for pasture and hay. Native grasses include big bluestem, green needlegrass, and western wheatgrass.

Representative profile of Bon loam, 0 to 2 percent slopes, in a pasture of native grass, 1,885 feet south and 968 feet west of the northeast corner of sec. 36, T. 104 N., R. 62 W.:

A11—0 to 6 inches, very dark gray (10YR 3/1) crushing to very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable; neutral; clear, smooth boundary.

A12—6 to 10 inches, very dark grayish-brown (10YR 3/2) crushing to dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky structure; soft, very friable; calcareous; mildly alkaline; clear, smooth boundary.

A13—10 to 19 inches, very dark gray (10YR 3/1) crushing to very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; weak, medium, prismatic structure that parts to weak, medium and fine, subangular blocky; soft, very friable; calcareous; mildly alkaline; clear, smooth boundary.

A14—19 to 32 inches, very dark gray (10YR 3/1) crushing to very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, very friable; a few, fine threads of segregated lime; calcareous; moderately alkaline; clear, wavy boundary.

C1—32 to 46 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, subangular blocky structure; slightly hard, very friable; common, fine threads of segregated lime; calcareous; moderately alkaline; clear, wavy boundary.

C2—46 to 58 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) when moist; single grained; loose; calcareous; moderately alkaline; clear, wavy boundary.

C3—58 to 66 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) when moist; massive; slightly hard, very friable; few, fine and medium masses of segregated lime; calcareous; moderately alkaline.

The A horizons combined range from 20 to 40 inches in thickness and are loam or very fine sandy loam. Depth to lime commonly ranges from 6 to 16 inches, but in places the A11 horizon is calcareous. The C horizon commonly is stratified, and texture in these horizons ranges from very fine sandy loam to fine and medium sand mixed with small amounts of fine gravel. In places faint yellow, brown, and gray mottles are in the lower part of the C horizon.

Bon soils are less silty and better drained than the nearby Clamo and Lamo soils. They are calcareous and contain more clay than Blendon soils.

Bon loam, 0 to 2 percent slopes (BoA).—This is the only Bon soil mapped in the county. It is on bottom lands, mainly along Firesteel Creek. The bottom lands are cut by stream channels into areas that range from 10 to 70 acres. Narrow sloping terrace fronts and partly filled stream meanders are in the areas.

Included with this soil in mapping are Lamo and Salmo soils in low areas of old channel meanders. The included areas are less than 15 percent of the mapped acreage.

Corn and small grains are the common crops grown in the larger areas. The smaller areas are in alfalfa, tame grasses, or native grasses. Bon soils are flooded in some years, but damage generally is slight, and the additional moisture is beneficial. The main concern of management is conserving moisture. Other concerns are maintaining fertility and organic-matter content. Capability unit IIc-1; pasture group K; windbreak group 1.

Clamo Series

The Clamo series are deep, poorly drained, nearly level, silty soils. They formed in clayey alluvium and are on bottom lands.

In a representative profile the surface layer is dark-gray silty clay loam about 9 inches thick. The subsoil is

about 15 inches thick. It is gray silty clay loam in the upper part and grayish-brown silty clay in the lower part. It is hard when dry and firm when moist. It contains mottles of olive and olive brown. The lower part is calcareous and has spots and streaks of lime. The underlying material is calcareous, dark-gray and very dark gray silty clay.

Clamo soils are high in fertility and in content of organic matter. Runoff and permeability are slow. These soils are subject to flooding and have a water table at a depth of 2½ to 10 feet. Available water capacity is moderate to high.

Some areas are cultivated. Corn, oats, grain sorghums, alfalfa, and tame grasses are the principal crops. Many areas are in native grasses and are used for pasture and hay. Native grasses include switchgrass, big bluestem, prairie cordgrass, and western wheatgrass. Kentucky bluegrass is present in many areas.

Representative profile of Clamo silty clay loam in native grass, 2,155 feet south and 100 feet east of the NW. corner of sec. 11, T. 104 N., R. 60 W.:

A11—0 to 4 inches, dark-gray (2.5Y 4/1) silty clay loam, black (2.5Y 2/1) when moist; moderate, fine, granular structure; slightly hard, friable, slightly sticky; neutral; clear, smooth boundary.

A12—4 to 9 inches, dark-gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) when moist; weak, coarse, prismatic structure that parts to weak, medium, and moderate, fine, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear, smooth boundary.

B2g—9 to 15 inches, gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) when moist; few, faint, olive mottles; weak, medium, prismatic structure that parts to moderate, medium and fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear, smooth boundary.

B3gca—15 to 24 inches, grayish-brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) when moist; few, fine, faint mottles of olive brown; weak, medium, prismatic structure that parts to moderate, medium and fine, subangular blocky; hard, firm, sticky and plastic; many, medium and coarse, soft masses of segregated lime; calcareous; moderately alkaline; clear, wavy boundary.

Cgca—24 to 38 inches, dark-gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) when moist; weak, coarse, subangular blocky structure; very hard, firm, sticky and plastic; few, fine, gypsum crystals; common to many, coarse, soft masses of segregated lime; calcareous; moderately alkaline; gradual, wavy boundary.

A11gb—38 to 42 inches, very dark-gray (5Y 3/1) silty clay, black (5Y 2/1) when moist; weak, coarse, subangular blocky structure; very hard, firm, sticky and plastic; moderately alkaline; gradual, wavy boundary.

A12gb—42 to 60 inches, dark-gray (2.5Y 4/1) silty clay, black (2.5Y 2/1) when moist; massive; very hard, firm, sticky and plastic; many, medium and coarse nests of gypsum crystals; moderately alkaline.

The combined A11 and A12 horizons range from 6 to 9 inches in thickness, from dark gray to very dark gray in color, and from silty clay loam to silty clay in texture. The combined B2g and B3gca horizons range from 14 to 27 inches in thickness and have a clay content ranging from 35 to 46 percent. Structure is weak, medium to coarse, prismatic that parts to weak to moderate, medium and fine, subangular blocky. Reaction of the A and B2g horizons ranges from neutral to mildly alkaline. Mottles in the B3g are few to common and faint to distinct, and in places they extend throughout the Cg horizons. The C horizons below a depth of 30 inches commonly consist of thin strata of coarser material ranging from silt to sand and fine gravel. Buried A horizons are common below a depth of 36 inches.

Clamo soils are more clayey than the nearby Bon, Lamo, and Salmo soils. They are not so well drained as Bon and Lamo soils, and they contain less salts than Salmo soils.

Clamo silty clay loam (0 to 2 percent slopes) (Ca).—This soil is on bottom lands along the James River and its main tributaries. Flooding occurs about once every 4 years. In the vicinity of the junction of Firesteel Creek and the James River, the material underlying this soil consists of strata of sand, as much as 3 feet thick, that are underlain by a buried clay soil.

Included with this soil in mapping are areas of Lamo and Salmo soils in places where the alluvium is more silty. Also included are areas of frequently flooded Clamo soils in old stream meanders and on the lower flood plains. These inclusions make up less than 15 percent of the mapped areas.

This soil is well suited to hay (fig. 6). If adequately drained, it is suited to cultivation. Controlling wetness is the main concern of management. Other concerns of management are improving tilth and maintaining fertility and organic-matter content. Capability unit IIw-1; pasture group A, drained, pasture group B, undrained; windbreak group 2.

Clamo silty clay loam, frequently flooded (0 to 1 percent slopes) (Cc).—This soil is on the lower level of bottom lands along the James River and also in old channel meanders. This soil is flooded almost every year. A thin organic layer is on the surface in places, and lime is at a greater depth than in the profile described as representative for the series, but the two profiles otherwise are similiar.

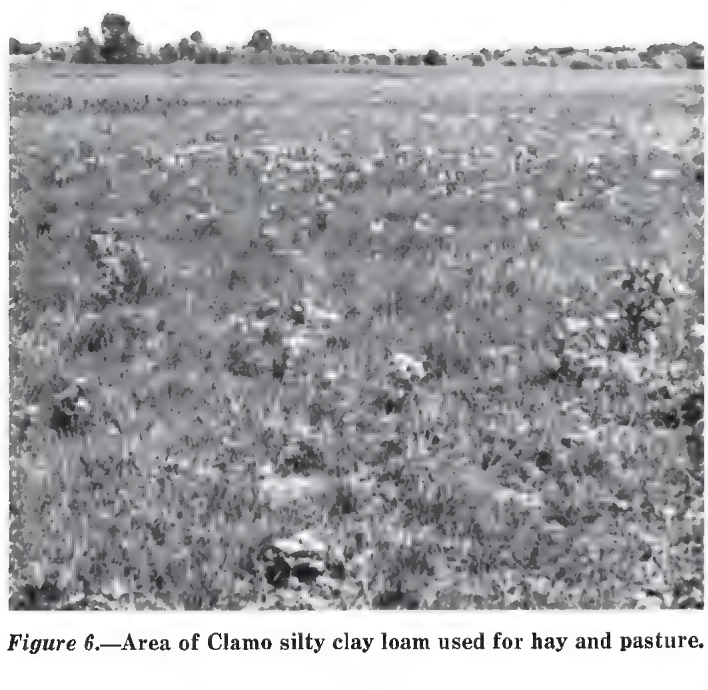

Figure 6.—Area of Clamo silty clay loam used for hay and pasture.

Included with this soil in mapping are small tracts of Clamo soils in slightly higher positions than this soil. Also included are Lamo and Salmo soils in scattered areas where the alluvium is more silty. In places these inclusions make up as much as 30 percent of the mapped areas.

Most of the area is in native grasses that are cut for hay. Wetness from frequent flooding causes this soil to be unsuitable for cultivation. It adversely affects hay harvest in some years. Capability unit Vw–1; pasture group B; windbreak group 2.

Clarno Series

The Clarno series consists of deep, well-drained, nearly level to undulating, loamy soils. These soils formed in glacial till on uplands.

In a representative profile the surface layer is dark-gray loam about 8 inches thick. The subsoil is about 22 inches thick. It is grayish-brown loam in the upper part and light yellowish brown in the lower part. It is slightly hard when dry and friable when moist. The lower part is calcareous and has many masses of lime that extend into the underlying material. The underlying material is calcareous, light yellowish-brown loam.

Clarno soils are medium in fertility and moderate in content of organic matter. Runoff is medium, and permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high.

Most areas of these soils are cultivated. Corn, grain and forage sorghum, small grains, alfalfa, and tame grasses are the principal crops. A few areas are in native grasses, which are mainly needle-and-thread, western wheatgrass, and blue grama.

Representative profile of a Clarno loam in a complex with Clarno-Houdek loams, 3 to 6 percent slopes, in a field of alfalfa, 1,155 feet west and 250 feet south of the northeast corner of sec. 3, T. 103 N., R. 61 W.:

Ap—0 to 6 inches, dark-gray (10YR 4/1) crushing to dark grayish-brown (10YR 4/2) loam, black (10YR 2/1) when moist; weak, medium and fine, subangular blocky structure that parts to weak, fine, granular; slightly hard, very friable, slightly sticky; neutral; abrupt, smooth boundary.

A12—6 to 8 inches, dark-gray (10YR 4/1) crushing to dark grayish-brown (10YR 4/2) loam, black (10YR 2/1) when moist; moderate, medium, subangular blocky structure that parts to weak, fine, subangular blocky; slightly hard, very friable, slightly sticky; neutral; clear, wavy boundary.

B21—8 to 12 inches, grayish-brown (10YR 5/2) crushing to brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; thin, continuous clay films on vertical surfaces of peds; mildly alkaline; clear, wavy boundary.

B22—12 to 16 inches, grayish-brown (2.5Y 5/2) crushing to light olive-brown (2.5Y 5/3) loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse and medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; thin, patchy clay films on vertical surfaces of peds; mildly alkaline; clear, wavy boundary.

B3ca—16 to 30 inches, light yellowish-brown (2.5Y 6/3) loam, grayish brown (2.5Y 5/2) when moist; weak, coarse, prismatic structure that parts to weak, coarse, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many, medium, prominent, soft masses of segregated lime; calcareous; moderately alkaline; diffuse boundary.

C1ca—30 to 48 inches, light yellowish-brown (2.5Y 6/3) loam, light olive brown (2.5Y 5/3) when moist; few, fine, faint mottles of light gray and olive yellow; weak, thick, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common to many, medium, distinct, soft masses of segregated lime; calcareous; strongly alkaline; diffuse boundary.

C2—48 to 60 inches, light yellowish-brown (2.5Y 6/3) loam, light olive brown (2.5Y 5/4) when moist; a few to common, fine, faint mottles of gray, olive yellow, and strong brown; weak, thick, platy structure; slightly hard, friable, slightly sticky and slightly plastic; few, fine, very dark brown iron-manganese segregations; few, fine threads of segregated lime; calcareous; strongly alkaline.

The combined Ap and A1 horizons range from 6 to 8 inches in thickness and from dark gray to dark grayish brown in color. The B2 horizon ranges from 6 to 12 inches in thickness, from loam to light clay loam in texture, and from dark brown to grayish brown in color. The B3ca horizon ranges from 8 to 16 inches in thickness. Depth to lime ranges from 12 to 30 inches. The C horizon ranges from loam to clay loam in texture, and in places it contains gypsum crystals in the lower part.

Clarno soils have a B2 horizon that is less clayey than that in the nearby Houdek soils, and they have a weaker structure than those soils. Clarno soils have a thicker B2 horizon than the nearby Ethan soils, and they are deeper to lime.

Clarno-Ethan loams, 3 to 6 percent slopes (CeB).—Clarno soils make up 60 percent of this complex, Ethan soils 25 percent, and less extensive soils the remaining 15 percent. Clarno soils are in the middle and lower parts of slopes, and Ethan soils are on the upper parts of slopes and on ridgetops. Each of these soils has a profile similar to that described for its respective series, except that in places Ethan soils are slightly to moderately eroded, and they have a calcareous surface layer. Many narrow swales and a few small depressions are scattered throughout the areas. Slopes are short and convex.

Included with these soils in mapping are areas of Betts, Prosper, Stickney, and Tetonka soils. Betts soils are on some of the ridgetops. Prosper and Stickney soils are in swales. Tetonka soils are in small depressions.

Most areas of these soils are cultivated. Corn, sorghum, small grains, alfalfa, and tame grasses are suitable crops. The main concern of management is the control of water erosion. Capability unit IIe–2; pasture group F; windbreak group 3.

Clarno-Ethan loams, 6 to 9 percent slopes (CeC).—Clarno soils make up 55 percent of this complex, Ethan soils 25 percent, and less extensive soils the remaining 20 percent. Clarno soils are on the sides of ridges. They have a thinner surface layer and subsoil than those in the profile described as representative for the Clarno series, but the two profiles otherwise are similar. Ethan soils are on the upper parts of slopes and on ridgetops. Their profile is similar to that described as representative for the Ethan series, except that their surface layer is calcareous in eroded areas. Many narrow swales and a few small depressions are in these undulating upland areas. Some of the ridgetops are moderately eroded.

Included with these soils in mapping are areas of Betts, Prosper, Stickney, and Tetonka soils. Betts soils are on some of the ridgestops. Prosper and Stickney soils are in swales. Tetonka soils are in depressions.

Most areas of these soils are cultivated, and the soils are well suited to all crops commonly grown in the county. The main concern of management is the control of water erosion. Use of waterways, terraces, and contour farming is difficult because of the short, irregular slopes. Capability unit IIIe-1; pasture group F; windbreak group 3.

Clarno-Houdek loams, 0 to 3 percent slopes (ChA).—Clarno soils make up 45 percent of this complex, Houdek soils 35 percent, and less extensive soils the remaining 20 percent. Clarno soils are on slight rises. Their surface layer and subsoil are thicker than those in the profile described as representative for the Clarno series, but the two profiles otherwise are similar. Houdek soils are more level than Clarno soils. They have a profile similar to that described as representative for the Houdek series. This complex is on uplands, mainly in the north-central and central parts of the county. The short, convex slopes generally are less than 3 percent, but small areas of steeper soils are included in the mapped areas.

Included with these soils in mapping are Ethan, Prosper, and Tetonka soils. Ethan soils are on the crests of some slopes. Prosper soils are in swales, and Tetonka soils are in small depressions.

Most areas of these soils are cultivated. Corn, sorghum, small grain, alfalfa, and tame grasses are suitable crops. The main concern of management is the conservation of moisture. Capability unit IIc-2; pasture group F; windbreak group 3.

Clarno-Houdek loams, 3 to 6 percent slopes (ChB).—Clarno soils make up 50 percent of this complex, Houdek soils 35 percent, and less extensive soils the remaining 15 percent. Clarno soils are on the upper parts of slopes. Their profile is the one described as representative for the Clarno series. Houdek soils, on the lower part of slopes, have a profile similar to the one described as representative for the Houdek series. These gently undulating soils are on uplands, mainly in the central and southeastern parts of the county. Slopes are of moderate length and are plane to convex in shape. Narrow swales and small depressions are scattered throughout the areas.

Included with these soils in mapping are areas of Betts, Ethan, Prosper, and Tetonka soils. Betts and Ethan soils are on some of the ridgetops and in places are eroded. Prosper soils are in swales, and Tetonka soils are in small depressions.

Most areas of these soils are cultivated. Corn, sorghum, small grains, alfalfa, and tame grasses are suitable crops. A few areas are in native grasses and are used for grazing. The main concern of management is the control of water erosion. Capability unit IIe-2; pasture group F; windbreak group 3.

Davison Series

In the Davison series are deep, moderately well drained, nearly level, calcareous, loamy soils on uplands. These soils formed in stratified, glacial melt-water deposits.

In a representative profile the surface layer is grayish-brown loam about 9 inches thick. The underlying material is loam and clay loam in the upper part and silt loam and sandy loam in the lower part. It is light gray and light brownish gray and has mottles of yellowish brown. Spots and streaks of lime are in the upper part.

Davison soils are medium to low in fertility and are moderate in content of organic matter. Runoff is slow, and permeability is moderate. A seasonal water table rises into the soil in spring. Available water capacity is moderate to high.

Corn, oats, sorghums, alfalfa, and tame grasses are the main crops.

Representative profile of Davison loam in an area of Davison-Hand loam, 0 to 2 percent slopes, in a plowed field, 1,130 feet south and 178 feet west of the NE. corner of sec. 3, T. 103 N., R. 60 W.:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, very friable; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 9 inches, grayish-brown (10YR 5/2) loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable; a few, fine segregations of lime; calcareous; moderately alkaline; abrupt, smooth boundary.

C1ca—9 to 15 inches, light-gray (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) when moist; few, fine, faint, light olive-brown mottles; weak, medium, subangular blocky structure; slightly hard, friable; common, medium segregations of lime; calcareous; moderately alkaline; clear, irregular boundary.

C2ca—15 to 24 inches, light brownish-gray (2.5Y 6/2) clay loam, olive brown (2.5Y 4/3) when moist; many, fine and medium, faint, yellowish-brown and dark yellowish-brown mottles; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common, medium segregations of lime; calcareous; strongly alkaline; gradual boundary.

C3—24 to 34 inches, gray (2.5Y 6/1) clay loam, gray (2.5Y 5/1) when moist; many, fine and medium, distinct, yellowish-brown and dark yellowish-brown mottles; weak, medium to thick, platy structure that parts to weak, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few, fine iron-manganese stains and concretions; few, medium segregations of lime; calcareous; moderately alkaline; clear, irregular boundary.

C4—34 to 38 inches, light-gray (5Y 7/1) silt loam, gray (5Y 5/1) when moist; many, medium and coarse, prominent, yellowish-brown and dark yellowish-brown mottles; massive; soft, very friable; few, fine iron-manganese concretions; calcareous; moderately alkaline; clear, irregular boundary.

C5—38 to 66 inches, light-gray (2.5Y 7/2) sandy loam, olive brown (2.5Y 4/4) when moist; many, medium, distinct, yellowish-brown mottles; massive; soft, very friable; common, medium, distinct iron-manganese stains and concretions; calcareous; moderately alkaline.

The A horizons range from 7 to 15 inches in thickness, from dark gray to grayish brown in color, and from loam to sandy loam in texture. In places there is a thin AC horizon. The Cca horizons range from 10 to 20 inches in thickness. The stratified material in the C horizons ranges from sandy loam to clay loam in texture, but in many places thin layers of coarser and finer textured material are below a depth of 40 inches.

Davison soils are finer textured and better drained than the nearby Fedora soils. They are in similar positions, but have a finer textured C horizon than Storla soils, which are underlain by sand and gravel at a moderate depth.

Davison-Hand loams, 0 to 2 percent slopes (DhA).—Davison soils make up 50 percent of this complex, Hand soils 30 percent, and other soils 20 percent. The complex is in slightly depressed areas on high upland terraces between the James River and Firesteel Creek. Typically,

the areas consist of broad, ill-defined drainageways interspersed with many slightly convex rises. Davison soils are on the concave slopes and their convex rims in the lower areas. Their profile is the one described as representative for the Davison series. Hand soils are on the rises. They have a slightly thicker surface layer and are deeper over lime than the soil described as representative for the Hand series, but the two profiles otherwise are similar.

Included with these soils in mapping are small tracts of Blendon, Enet, and Fedora soils. Blendon and Enet soils are on some of the rises where the soils are more sandy or are underlain by sand and gravel. Fedora soils are in some of the low areas.

Most areas are farmed. Corn, oats, sorghum, alfalfa, and tame grasses are suitable crops. The Davison soils are high in lime and are subject to soil blowing. Controlling soil blowing is the main concern of management. Other concerns of management are improvement of fertility and maintenance of organic-matter content. Capability unit IIe-1; Davison soils are in pasture group K, windbreak group 1; Hand soils are in pasture group F, windbreak group 3.

Delmont Series

In the Delmont series are somewhat excessively drained, nearly level to gently undulating, loamy soils that are shallow to sand and gravel. These soils formed in alluvium and are on uplands and stream terraces.

In a representative profile the surface layer is very dark gray loam about 6 inches thick. The subsoil is very dark gray and very dark grayish-brown loam about 9 inches thick. It is soft when dry and very friable when moist. The underlying material is calcareous, grayish-brown and light brownish-gray sand and gravel.

Delmont soils are low to medium in fertility and are moderate in content of organic matter. Runoff is medium and permeability is moderately rapid. Available water capacity is low.

Most areas are cultivated. Corn, oats, grain sorghum, alfalfa, and tame grasses are the main crops. Small areas are in native grasses. Native grasses include little bluestem, side-oats grama, needle-and-thread, and blue grama.

Representative profile of Delmont loam in an area of Enet-Delmont loams, 0 to 3 percent slopes, in a cultivated field, 320 feet north and 95 feet east of the SW. corner of sec. 31, T. 104 N., R. 61 W.:

Ap—0 to 6 inches, very dark gray (10YR 3/1) crushing to very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky and weak, fine, granular; soft, very friable; mildly alkaline; abrupt, wavy boundary.

B1—6 to 9 inches, very dark gray (10YR 3/1) crushing to very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) when moist; weak, coarse, prismatic structure that parts to weak, medium and fine, subangular blocky; soft, very friable; mildly alkaline; clear, wavy boundary.

B2—9 to 15 inches, very dark grayish-brown (10YR 3/2) loam, very dark brown (10YR 2/2) when moist; weak, coarse, prismatic structure that parts to weak, coarse and medium, subangular blocky; soft, very friable; mildly alkaline; clear, wavy boundary.

IIC1ca—15 to 24 inches, grayish-brown (10YR 5/2) gravel mixed with sand, dark grayish brown (10YR 4/2) when moist; single grained; loose; few, coarse masses of segregated lime; gravel coated with lime crusts; calcareous; moderately alkaline.

IIC2—24 to 66 inches, light brownish-gray (10YR 6/2) medium and coarse sand mixed with gravel, grayish brown (10YR 5/2) when moist; single grained; loose; calcareous; moderately alkaline.

The A horizon ranges from 4 to 7 inches in thickness, from very dark gray to dark grayish brown in color, and from very fine sandy loam to silt loam in texture. The B horizons range from 6 to 13 inches in thickness and from very dark gray to dark grayish brown in color. Depth to gravel ranges from 10 to 20 inches. The gravel commonly is coarse in the upper part and it becomes finer and cleaner with depth.

Delmont soils have thinner A and B horizons than the nearby Enet soils, and they are more shallow to sand and gravel.

Delmont loam, 3 to 6 percent slopes (DmB).—This soil is on terraces and uplands in the east-central and south-central parts of the county. In places the surface layer and the subsoil contain more silt and less sand than those in the profile described as representative for the series. Also, the depth to sand and gravel is slightly less on some of the ridgetops.

Included with this soil in mapping are small tracts of Enet soils on the lower slopes.

Most areas are farmed, but this soil is droughty. The main concerns of management are control of water erosion and soil blowing. Capability unit IVe-1; pasture group D; windbreak group 10.

Dudley Series

In the Dudley series are deep, moderately well drained to somewhat poorly drained, nearly level, silty soils. These soils formed in glacial till and are on uplands.

In a representative profile the surface layer is dark-gray silt loam about 7 inches thick. The subsurface layer is gray silt loam about 2 inches thick. The subsoil, about 21 inches thick, is clay loam that is very hard when dry and very firm when moist. It is dark gray in the upper part and dark grayish brown to grayish brown in the lower part. The lower part is calcareous, and it contains nests of gypsum crystals. The underlying material is calcareous, grayish-brown and light yellowish-brown clay loam.

Dudley soils are medium in fertility and moderate in content of organic matter. Runoff is slow, and permeability is slow or very slow. Available water capacity is moderate to high.

Dudley soils in Davison County are mapped only with Stickney soils.

Most areas are cultivated, and small grains, sorghums, alfalfa, and tame grasses are the main crops. A few areas are in native grasses and are used as pasture.

Representative profile of a Dudley silt loam in an area of Stickney-Dudley complex, 0 to 2 percent slopes, in native grass, 1,715 feet west and 315 feet north of the SE. corner of sec. 33, T. 102 N., R. 62 W.:

A1—0 to 7 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable; slightly acid; clear, wavy boundary.

A2—7 to 9 inches, gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) when moist; weak, thin, platy structure that parts to weak, fine, granular; soft, very friable; neutral; clear, wavy boundary.

B21t—9 to 12 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) when moist; thin, nearly continuous, gray (10YR 6/1) coatings on column tops; strong, medium, columnar structure that parts to strong, medium, blocky; very hard, very firm, sticky and plastic; thin, continuous clay films on all faces of peds; neutral; clear, wavy boundary.

B22t—12 to 20 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) when moist; moderate, medium, prismatic structure that parts to strong, medium, blocky; very hard, very firm, sticky and plastic; thin, continuous clay films on all faces of peds; moderately alkaline; clear, wavy boundary.

B31cs—20 to 25 inches, dark grayish-brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and plastic; many, fine and medium nests and threads of gypsum crystals; strongly alkaline; clear, wavy boundary.

B32cs—25 to 30 inches, grayish-brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, sticky and plastic; common, fine and medium nests of gypsum crystals; calcareous; moderately alkaline; gradual, wavy boundary.

C1cs—30 to 36 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common, fine and medium nests of gypsum crystals; few, fine, soft masses of segregated lime; calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—36 to 60 inches, light yellowish-brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) when moist; many, fine, faint, light-gray and a few, fine, distinct, yellowish-brown mottles; weak, fine, blocky structure; hard, friable; few, fine, gypsum crystals; common, fine and medium masses of segregated lime; calcareous; moderately alkaline.

The A horizons are loam or silt loam. The A1 horizon ranges from 4 to 8 inches in thickness and from gray to very dark grayish brown in color. The A2 horizon ranges from 1 to 3 inches in thickness and from gray or light gray to light brownish gray in color. In some cultivated areas, the material in the A2 horizon is mixed with that in the Ap horizon. The B2t horizons range from 6 to 15 inches in thickness, from very dark gray to dark grayish brown in color, and from moderate to strong in grade of structure. Texture of the B2t horizons is silty clay loam, clay loam, or clay, and the content of clay ranges from 35 to 50 percent. The B3cs horizons range from 3 to 12 inches in thickness. The C horizons range from loam to clay loam in texture and are friable or firm when moist.

Dudley soils have a slightly thinner A horizon than the nearby Stickney soils, and they have a columnar structure in the B21t horizon. They lack the B & A horizon of the Stickney soils.

Enet Series

In the Enet series are well drained, nearly level to gently undulating, loamy soils that are moderately deep over sand and gravel. These soils formed in alluvium over gravelly, glacial melt-water deposits and are on uplands and terraces.

In a representative profile (fig. 7) the surface layer is very dark gray loam about 5 inches thick. The subsoil, about 19 inches thick, is very dark gray loam in the upper part and dark grayish-brown sandy loam in the lower part. It is slightly hard when dry and friable when moist. The underlying material is calcareous, light brownish-gray and pale-brown gravelly loamy sand over multicolored sand and gravel.

Enet soils are medium in fertility and are moderate in content of organic matter. Runoff is slow to medium. Permeability is moderate in the surface layer and the subsoil and rapid in the underlying material. Available water capacity is low.

Most areas are cultivated. Corn, oats, alfalfa, grain sorghums, and tame grasses are the principal crops. A few areas are in native grasses and are used for pasture. Native grasses include needle-and-thread, blue grama, and western wheatgrass.

Representative profile of Enet loam, 0 to 3 percent slopes, in native grass, 1,895 feet south and 128 feet east of the NW. corner of sec. 16, T. 102 N., R. 60 W.:

A1—0 to 5 inches, very dark gray (10YR 3/1) crushing to very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) when moist; weak, medium and fine, subangular blocky structure that parts to weak, fine, granular; soft, very friable; neutral; clear, smooth boundary.

B21—5 to 10 inches, very dark gray (10YR 3/1) crushing to very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, friable; neutral; clear, wavy boundary.

B22—10 to 19 inches, very dark gray (10YR 3/1) crushing to very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, friable, slightly sticky; thin, patchy clay films on vertical faces of peds; neutral; clear, wavy boundary.

B3—19 to 24 inches, dark grayish-brown (10YR 4/2) crushing to dark-brown (10YR 4/3) sandy loam, very dark grayish brown (10YR 3/2) crushing to dark brown (10YR 3/3) when moist; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, very friable; mildly alkaline; clear, wavy boundary.

IIC1ca—24 to 32 inches, light brownish-gray (10YR 6/2) and pale-brown (10YR 6/3) gravelly loamy sand, brown (10YR 5/3) when moist; single grained; loose; few to common, coarse, soft masses of segregated lime and thick lime crusts on gravel; calcareous; moderately alkaline; gradual boundary.

IIC2—32 to 60 inches, multicolored sand and gravel; single grained; loose; calcareous; moderately alkaline.

The A horizon ranges from 5 to 9 inches in thickness and from very dark gray to dark grayish brown in color. The B2 horizons range from 10 to 18 inches in thickness and from very dark gray to grayish brown in color. Texture of the B2 horizons commonly is loam, but it is sandy clay loam or clay loam in places. A B3 or a C horizon, or both, commonly are present; and they range from loam to sandy loam in texture and from dark grayish brown to brown in color. Depth to sand and gravel ranges from 20 to 36 inches. In the upper part of the IIC horizon, the gravel commonly is coarse.

Enet soils have thicker A and B horizons and are deeper over sand and gravel than the nearby Delmont soils. They formed in similar material but are better drained than the calcareous Storla soils.

Enet loam, 0 to 3 percent slopes (EnA).—This soil is on uplands and terraces in the northern and eastern parts of the county. The profile is the one described as representative for the series.

Included with this soil in mapping are areas of Delmont soils and areas of a soil that has a more sandy surface layer and subsoil, over sand and gravel, than Enet soils. These inclusions are on slight rises and make up about 20 percent of the mapped areas.

Most areas are cultivated; but this soil is droughty, and crop growth is affected in dry years. The concerns of management are conservation of moisture, control of soil blowing, and maintenance of organic-matter content and fertility. Capability unit IIIs–2; pasture group D; windbreak group 6.

Enet-Delmont loams, 0 to 3 percent slopes (EoA).—Enet soils make up 60 percent of this complex, Delmont soils 30 percent, and other soils 10 percent. The areas are on uplands and terraces, mainly in the northern and eastern parts of the county. Enet soils are in the more level areas. They have a profile similar to the one described as representative for the Enet series. Delmont soils are on convex, low-lying ridges and humps within the areas. Their profile is the one described as representative for the Delmont series.

Included with these soils in mapping are narrow tracts of Storla soils along drainageways.

Most areas are farmed, but these soils are droughty. The concerns of management are conservation of moisture, control of soil blowing, and maintenance of organic-matter content and fertility. Enet soils are in capability unit IIIs–2, pasture group D, windbreak group 6; Delmont soils are in capability unit IVs–2, pasture group D, windbreak group 10.

Enet-Delmont loams, 3 to 6 percent slopes (EoB).—Enet soils make up 55 percent of this complex, Delmont soils 30 percent, and other soils 15 percent. Enet soils are on side slopes, and Delmont soils are on the shorter and more convex upper parts of slopes and on ridgetops. Both soils are slightly more silty than the soil described as representative for their respective series, and the surface and subsoil layers of the Enet soils are thinner, but the profiles otherwise are similar.

Included with these soils in mapping are Storla soils in narrow tracts along drainageways.

Nearly all of this complex is farmed, but these soils are droughty. Controlling water erosion is the main concern of management. Other important concerns of management are conservation of moisture, control of soil blowing, and maintenance of organic-matter content and fertility. Enet soils are in capability unit IIIe–2, pasture group D, windbreak group 6; Delmont soils are in capability unit IVe–1, pasture group D, windbreak group 10.

Enet-Storla loams, 0 to 2 percent slopes (EsA).—Enet soils make up 70 percent of this complex, Storla soils 25 percent, and other soils 5 percent. The areas are narrow and are along drainageways on upland terraces where they merge with the more poorly drained, old glacial melt-water channels. Enet soils are in the better drained areas. Their subsoil is somewhat more clayey than that of the soil described as representative for the Enet series, but the profiles otherwise are similar. Storla soils are in the lower areas. They have a profile similar to the one described as representative for the Storla series.

Included with these soils in mapping are Delmont soils on slight rises.


Figure 7.—Profile of an Enet loam.

Most areas are cultivated. These soils are droughty, but this condition is partly offset by runoff from adjacent soils and the seasonal rise of the water table in the Storla part of the complex. Both soils are in capability unit IIIs–2; Enet soils are in pasture group D, windbreak group 6; Storla soils are in pasture group A, windbreak group 2.

Ethan Series

In the Ethan series are deep, well-drained, gently undulating to steep, loamy soils. These soils formed in calcareous glacial till on uplands.

In a representative profile the surface layer is dark-gray loam about 6 inches thick. The subsoil, about 18

inches thick, is dark grayish-brown loam in the upper part and light brownish-gray loam in the lower part. It is slightly hard when dry and friable when moist. The lower part is calcareous and contains masses of lime that extend into the underlying material. The underlying material is calcareous light yellowish-brown loam.

Ethan soils are moderately low in content of organic matter and are medium to low in fertility. Runoff is medium to rapid, and permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high.

The more gently sloping areas are cultivated. Corn, oats, alfalfa, grain sorghums, and tame grasses are the major crops. The steeper areas are in native grasses and are used for grazing. Native grasses include little bluestem, side-oats grama, blue grama, and buffalograss.

Representative profile of Ethan loam in an area of Betts and Ethan loams, 21 to 40 percent slopes, in a cultivated field, 2,370 feet east and 120 feet south of the NW. corner of sec. 19, T. 104 N., R. 60 W.:

Ap—0 to 6 inches, dark-gray (10YR 4/1) crushing to dark grayish-brown (10YR 4/2) loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, very friable; neutral; abrupt, smooth boundary.

B2—6 to 9 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to weak, medium and fine, subangular blocky; slightly hard, friable; very thin, patchy clay films on vertical faces of peds; mildly alkaline; clear, wavy boundary.

B3ca—9 to 24 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, very friable; patchy, grayish-brown (2.5Y 5/2) organic stains on faces of peds; few to common, medium masses of segregated lime; calcareous; moderately alkaline; diffuse, irregular boundary.

C1ca—24 to 48 inches, light yellowish-brown (2.5Y 6/3) loam, light olive brown (2.5Y 5/3) when moist; few, fine, faint mottles of olive yellow, very dark brown, and yellowish brown; weak, thick, platy and weak, coarse, subangular blocky structure; slightly hard, friable; common, medium and coarse masses of segregated lime; calcareous; strongly alkaline; diffuse boundary.

C2—48 to 60 inches, light yellowish-brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) when moist; common, fine, olive-yellow mottles and very dark brown iron stains; very weak, thick, platy structure; slightly hard, friable; few, fine threads of segregated lime; calcareous; strongly alkaline.

The A horizon ranges from 5 to 7 inches in thickness and from very dark gray to grayish brown in color. The B2 horizon ranges from 3 to 5 inches in thickness and from dark grayish brown to brown in color. In some cultivated areas the A and B2 horizons are calcareous. The B3ca horizons range from 12 to 20 inches in thickness. The C horizons range from loam to clay loam in texture. In places gypsum is in the lower part below the lime accumulation layers.

Ethan soils formed in the same material as the nearby Houdek, Clarno, and Betts soils. Ethan soils have less clayey and weaker structured B2 horizons than Houdek soils, and they are not so deep over lime as those soils. They have thinner B2 horizons and are more shallow to lime than Clarno soils. Ethan soils have thicker A and B horizons than Betts soils.

Ethan-Betts loams, 5 to 9 percent slopes, eroded (EtC2).—Ethan soils make up 40 percent of this complex, Betts soils 25 percent, and other soils 35 percent. Many of the areas are in the central and southern parts of the county. Ethan soils are on side slopes and Betts soils are on the upper parts of slopes and on ridgetops. The surface layer of the Ethan soils is calcareous, and in eroded areas it is lighter colored than in the profile described as representative for the Ethan series; but the profiles otherwise are similar. The original surface layer of the Betts soils in most areas has been removed by erosion, and some of the material is spread over the surface of the Ethan soils downslope (fig. 8).

Included with these soils in mapping are small tracts of Clarno, Prosper, and Tetonka soils. Clarno soils are on the lower slopes. Prosper soils are in swales, and Tetonka soils are in depressions.

All areas are cultivated, but the content of organic matter and fertility have been lowered through erosion. Controlling erosion is the main management problem. Capability unit VIe–1; pasture group G; windbreak group 10.

Fedora Series

In the Fedora series are deep, somewhat poorly drained, nearly level, calcareous, loamy soils. These soils formed in glacial melt-water deposits on uplands and high terraces.

In a representative profile the surface layer is dark-gray sandy loam about 8 inches thick. Below this layer is a transition layer consisting of gray loamy sand about 4 inches thick. It is loose when dry and very friable when moist. The underlying material is calcareous, light-gray and gray sandy loam to a depth of 40 inches over multicolored sand and gravel.

Fedora soils are moderate in content of organic matter and low in fertility. Runoff is slow, and permeability is moderately rapid. The water table is at a depth of 2 to 4 feet in spring and recedes to a depth below 4 feet late in summer. Available water capacity is low to moderate.

Most areas are cultivated. Corn, oats, sorghums, alfalfa, and tame grasses are the main crops. Some areas are in native grasses and are used for grazing. Native grasses include switchgrass, prairie sandreed, needle-and-thread, blue grama, and inland saltgrass. Kentucky bluegrass is common in some areas.

Representative profile of Fedora sandy loam, 0 to 3 percent slopes, in native grass pasture, 216 feet south and 315 feet west of the NE. corner of sec. 4, T. 103 N., R. 60 W.:

A1—0 to 8 inches, dark-gray (10YR 4/1) sandy loam, black (10YR 2/1) when moist; few, fine, faint, very dark grayish-brown mottles; weak, fine, granular structure; soft, very friable; calcareous; moderately alkaline; clear, wavy boundary.

AC—8 to 12 inches, gray (10YR 5/1) loamy sand, very dark gray (10YR 3/1) when moist; few, fine, faint, dark grayish-brown mottles; single grained; loose, very friable; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—12 to 21 inches, light-gray (2.5Y 7/1) sandy loam, gray (2.5Y 5/1) when moist; many, fine, distinct, very dark grayish-brown and dark-brown mottles; massive; soft, very friable; few, fine iron-manganese segregations; common, fine to medium segregations

of lime; calcareous; moderately alkaline; diffuse, wavy boundary.

C2—21 to 40 inches, gray (5Y 6/1) sandy loam, gray (5Y 5/1) when moist; many, fine, distinct, olive-brown and dark-gray mottles; massive; soft, very friable; many iron-manganese segregations; calcareous; moderately alkaline; clear, wavy boundary.

IIC3—40 to 66 inches, multicolored sand and gravel, dominantly grayish brown (10YR 5/2), dark brown (10YR 4/3) when moist; single grained; loose; calcareous; moderately alkaline.

The A1 horizon ranges from 6 to 10 inches in thickness and from dark gray to very dark gray in color. Texture commonly is sandy loam, but it ranges from loamy sand to loam. Where present, the AC horizon is as much as 6 inches thick. The C1ca horizon ranges from 8 to 14 inches in thickness, from sandy loam to loamy sand in texture, and from moderately alkaline to strongly alkaline in reaction. The C2 horizon ranges from sandy loam to loamy sand in texture. The multicolored loose sand and gravel ranges in depth from 40 to 60 inches or more.

Fedora soils formed in similar materials to Davison and Storla soils, but they are more sandy. They are deeper over sand and gravel than Storla soils.

Fedora sandy loam, 0 to 3 percent slopes (FeA).—This is the only Fedora soil mapped in the county. It is in broad, slightly depressed areas on uplands.

Included with this soil in mapping are Blendon and Enet soils. They are on the better drained rises and in places make up as much as 25 percent of the mapped areas. Also included are a few areas where the soil has a thicker surface layer than this soil.

Many areas are farmed, but crop growth is affected by the high-lime content and low fertility. Farming operations are delayed in some years because of wetness, but the water table recedes in summer, and the soil is droughty in dry years. Crops that have deep roots that reach the water table are better suited than shallow-rooted crops. Cultivated areas are subject to soil blowing in dry years. Capability unit IIIw-1; pasture group A; windbreak group 2.

Firesteel Series

In the Firesteel series are moderately well drained to somewhat poorly drained, nearly level, calcareous, silty soils that are moderately deep over chalky siltstone. These soils formed in loamy alluvium on terraces and uplands.

In a representative profile the surface layer is gray silt loam about 7 inches thick. Below this layer is a transitional layer of gray and light-gray silt loam about 8 inches thick. It is soft when dry and very friable when moist. The underlying material is white silt loam underlain by white chalky siltstone at a depth of 30 inches.

Firesteel soils are moderately low in content of organic matter and low in fertility. Runoff is slow, and permeability is moderate. The water table rises in spring to about 2 feet below the surface. Available water capacity is moderate to low.

Many areas are in native grasses and are used for grazing. Little bluestem, side-oats grama, needle-and-thread, blue grama, and buffalograss are the main grasses. A few areas are cultivated.

Representative profile of Firesteel silt loam, 0 to 2 percent slopes, in a cultivated field, 1,580 feet north and

Figure 8.—An area of Ethan-Betts loams, 5 to 9 percent slopes, eroded.

72 feet east of the SW. corner of sec. 31, T. 104 N., R. 61 W.:

Ap—0 to 7 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, fine, granular structure; soft, very friable; calcareous; moderately alkaline; abrupt, smooth boundary.

AC—7 to 15 inches, gray (2.5Y 6/1) and light-gray (2.5Y 7/1) silt loam, dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) when moist; weak, medium and coarse, prismatic structure that parts to weak, medium, subangular blocky; soft, very friable; a few gypsum crystals; calcareous; strongly alkaline; clear, wavy boundary.

C1ca—15 to 30 inches, white (2.5Y 8/2) silt loam; light yellowish brown (2.5Y 6/3) when moist; massive; slightly hard, friable; common, fine, hard fragments of siltstone; common seams of gypsum crystals; common, medium segregations of lime; calcareous; strongly alkaline; gradual, wavy boundary.

C2—30 to 60 inches, white (5Y 8/2) soft bedded siltstone, pale yellow (5Y 7/3) when moist; platy structure with plates ranging from 1/4 to 2 inches in thickness; very hard, friable; many, thin seams of gypsum; calcareous; strongly alkaline.

The A horizon ranges from 6 to 9 inches in thickness and from gray to very dark grayish brown in color. Texture commonly is silt loam, but it is loam in places. The AC horizon ranges from 8 to 16 inches in thickness. Gypsum crystals in the C1ca horizon range from a few to many. Depth to the bedded siltstone ranges from 24 to 40 inches.

Firesteel soils are underlain by siltstone at a moderate depth, and in that respect they differ from Davison, Fedora, and Storla soils, which also are calcareous and moderately well to somewhat poorly drained. In addition, they are more loamy and less sandy than Fedora soils.

Firesteel silt loam, 0 to 2 percent slopes (FsA).—This is the only Firesteel soil mapped in the county. It is mainly on high terraces (fig. 9) along Firesteel Creek.

Figure 9.—**Area of Firesteel silt loam, 0 to 2 percent slopes, used for growing hay.**

Included with this soil in mapping are Blendon soils in narrow tracts along drainageways and on foot slopes. In places there is a soil with a thinner surface layer than the Firesteel soils. These inclusions make up about 10 percent of the mapped areas. Also included are a few areas of Firesteel soils that have a thicker surface layer than this soil.

A few areas are cultivated. Crop growth is affected by the high-lime content and low fertility. The water table is at a depth of about 3 feet in spring. Many areas are in native grasses and are used for grazing and for hay. Improving organic matter content and fertility are concerns of management. Cultivated areas are subject to soil blowing. Capability unit IIIs-3; pasture group F; windbreak group 2.

Gavins Series

In the Gavins series are excessively drained, hilly to steep, calcareous, silty soils that are shallow to siltstone. These soils are on uplands, mainly on side slopes adjacent to streams.

In a representative profile the surface layer is dark-gray silt loam about 4 inches thick. The subsoil is pale-brown silt loam about 6 inches thick. It is soft when dry and very friable when moist. The underlying material is very pale brown silt loam over very pale brown, bedded siltstone at a depth of 18 inches. Fragments of siltstone are throughout the profile and on the surface.

Gavins soils are low in content of organic matter and in fertility. Runoff is rapid, and permeability is moderate. Available water capacity is low.

Most areas are in native grass and are used for grazing. Native grasses include little bluestem, side-oats grama, blue grama, and buffalograss.

Gavins soils in Davison County are mapped only with Betts soils.

Representative profile of Gavins silt loam in an area of Betts-Gavins complex, 15 to 40 percent slopes, in native grass, 1,540 feet south and 425 feet east of the NW. corner of sec. 22, T. 102 N., R. 61 W.:

A1—0 to 4 inches, dark-gray (10YR 4/1) silt loam, very dark grayish brown (10YR 3/2) when moist; very dark brown (10YR 2/2) coatings on some peds; weak, fine, granular structure; soft, very friable; abundant, coarse and fine roots; common, fine fragments of hard siltstone; calcareous; moderately alkaline; clear, smooth boundary.

B2—4 to 10 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; very weak, medium, prismatic structure that parts to weak, fine, subangular blocky and weak, fine, granular; soft, very friable; many, fine roots; common, fine to medium fragments of hard siltstone; calcareous; moderately alkaline; gradual, wavy boundary.

C1—10 to 18 inches, very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) when moist; massive; soft, very friable; many, fine roots; many, fine to coarse fragments of hard siltstone; calcareous; strongly alkaline; diffuse, irregular boundary.

C2—18 to 60 inches, very pale brown (10YR 7/4, 8/4) bedded siltstone, very pale brown (10YR 7/4) when moist; very hard, friable, slightly sticky; thin layers of gypsum between bedding planes; calcareous; strongly alkaline.

Depth to siltstone ranges from 10 to 20 inches. In places the upper 10 inches of these soils formed in a thin mantle of glacial till or in local alluvium containing rounded pebbles and cobblestones of igneous origin. The A1 horizon ranges from 3 to 5 inches in thickness, from dark gray to grayish brown in color, and from silt loam to loam in texture. The B2 horizon ranges from 3 to 7 inches in thickness, from pale brown to light brownish gray in color, and from loam to silty clay loam in texture. The C horizons range from very pale brown to yellow in color. The bedded siltstone is soft and is easily penetrated, but it becomes hard when exposed to air.

Gavins soils are similar to Redstoe soils, but they have thinner A and B horizons and are more shallow to siltstone than those soils. They are more silty than the nearby Betts soils, which formed in glacial till.

Hand Series

The Hand series consists of deep, well-drained, nearly level to gently undulating, loamy soils on uplands. These soils formed in stratified glacial melt-water deposits.

In a representative profile the surface layer is dark-gray loam about 8 inches thick. The subsoil is grayish-brown loam about 14 inches thick. It is slightly hard when dry and friable when moist. The lower part is calcareous. The underlying material is calcareous light-gray clay loam to a depth of 32 inches and is stratified light yellowish-brown loamy fine sand and silt below.

Hand soils are moderate in organic-matter content and medium in fertility. Runoff is medium, and permeability is moderate. Available water capacity is moderate to high.

Most areas are farmed. All crops commonly grown in the county are suitable. A few areas are in native grasses and are used for grazing. Native grasses include green needlegrass, needle-and-thread, blue grama, and buffalograss.

Representative profile of Hand loam in an area of Hand-Davison loams, 0 to 3 percent slopes, in a plowed field, 385 feet south and 425 feet east of the NW. corner of sec. 2, T. 103 N., R. 60 W.:

Ap—0 to 5 inches, dark-gray (10YR 4/1) loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky and weak, fine, granular structure; soft, very friable; mildly alkaline; abrupt, smooth boundary.

A12—5 to 8 inches, dark-gray (10YR 4/1) loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; soft, friable; mildly alkaline; clear, wavy boundary.

B2—8 to 15 inches, grayish-brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) when moist; weak, coarse, prismatic structure that parts to weak, coarse and medium, subangular blocky; slightly hard, friable; mildly alkaline; abrupt, wavy boundary.

B3—15 to 22 inches, grayish-brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse and medium, subangular blocky structure; slightly hard, friable; calcareous; moderately alkaline; abrupt, irregular boundary.

C1ca—22 to 32 inches, light-gray (2.5Y 7/2) clay loam, light brownish gray (10YR 6/2) when moist; common, fine, distinct, yellowish-brown and common, medium, distinct, gray mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; many, medium and large, prominent segregations of lime; calcareous; moderately alkaline; abrupt, irregular boundary.

IIC2—32 to 60 inches, light yellowish-brown (2.5Y 6/4) stratified loamy fine sand and silt, light olive brown (2.5Y 5/4) when moist; many, large, prominent, gray and common, fine, distinct, brownish-yellow mottles; single grained; soft, loose; mildly alkaline.

Combined thickness of the A horizons ranges from 5 to 9 inches. Texture commonly is loam, but it ranges to very fine sandy loam. Combined thickness of the B horizons ranges from 13 to 23 inches. Depth to lime ranges from 12 to 20 inches. In places the C horizons have thin lenses of clay loam, about ½ to 1 inch thick, between thicker layers of fine sand and silt.

Hand soils are similar to Clarno soils, but they formed in more stratified material. They are deeper to lime and are better drained than the nearby Davison soils.

Hand loam, 3 to 6 percent slopes (HaB).—This soil is on uplands between the James River and Firesteel Creek. The areas have the appearance of old terrace fronts, and the convex slopes are short and irregular. The surface layer is thinner, and depth to lime is less than in the profile described as representative for the series, but the two profiles otherwise are similar. Eroded areas on the upper parts of some slopes make up about 5 percent of a given area.

Included with this soil in mapping are areas of Blendon and Delmont soils. They are in areas where the soil is more sandy or where sand and gravel are near the surface. These inclusions make up about 15 percent of the mapped areas.

Most areas are cultivated. Controlling water erosion is the main management concern. Capability unit IIe-2; pasture group F; windbreak group 3.

Hand-Davison loams, 0 to 3 percent slopes (HdA).—Hand soils make up about 70 percent of this nearly level complex, Davison soils 20 percent, and other soils 10 percent. The areas typically consist of ill-defined drainageways with many small, convex rises. On the crests of the rises are small amounts of gravel and cobblestones on the surface in some places. Hand soils are on the well-drained rises. Their profile is the one described as representative for the series, but in a few places the surface layer is fine sandy loam. Davison soils are in the low areas along the drainageways. Their profile is similar to that described as representative for the Davison series, except that in a few places the surface layer is thinner.

Included with these soils in mapping are Delmont and Fedora soils. Delmont soils are on some of the rises. Fedora soils are in some of the low areas.

Most areas are farmed. Conserving moisture is the main concern of management on the Hand soils. The Davison part of the complex is high in lime and is subject to soil blowing. Both soils are in capability unit IIc-2; Hand soils are in pasture group F, windbreak group 3; Davison soils are in pasture group K, windbreak group 1.

Houdek Series

In the Houdek series are deep, well drained, nearly level to gently undulating, loamy soils. These soils formed in glacial till on uplands.

In a representative profile (fig. 10) the surface layer is dark grayish-brown loam about 6 inches thick. The subsoil, about 22 inches thick, is clay loam that is dark grayish brown in the upper part, grayish brown in the middle part, and light olive brown in the lower part. It is hard when dry and friable when moist. The lower part is calcareous. The underlying material is calcareous light yellowish-brown clay loam.

Houdek soils are moderate in organic-matter content and medium to high in fertility. Runoff is slow to medium, and permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high.

Most areas are farmed. All crops commonly grown in the county are suited to these soils. Small areas are in native grasses and are used for grazing and hay. Native grass species include western wheatgrass, needle-and-thread, blue grama, and buffalograss.

Representative profile of a Houdek loam in an area of Houdek-Prosper loams, 0 to 2 percent slopes, in a cultivated field, 1,185 feet north and 365 feet west of the SE. corner of sec. 9, T. 101 N., R. 61 W.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, friable, slightly sticky; neutral; abrupt, smooth boundary.

B21t—6 to 10 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) crushing to dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; thin, continuous clay films on faces of peds; few very dark brown

Figure 10.—Profile of a Houdek loam.

(10YR 2/2) organic stains on verticle faces of peds; neutral; clear, wavy boundary.

B22t—10 to 18 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) crushing to brown (10YR 5/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, subangular blocky; hard, friable, sticky and plastic; thin, continuous clay films on all faces of peds; mildly alkaline; clear, wavy boundary.

B3ca—18 to 28 inches, light olive-brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) when moist; weak, medium, prismatic structure that parts to moderate, medium and fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; few, medium masses of segregated lime; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—28 to 38 inches, light yellowish-brown (2.5YR 6/3) clay loam, light olive brown (2.5Y 5/3) when moist; common, medium, distinct mottles of dark brown and gray; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common, medium, prominent masses of segregated lime; calcareous; moderately alkaline; diffuse boundary.

C2—38 to 60 inches, light yellowish-brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) when moist; few, fine, faint mottles of olive brown and gray, when moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; few nests and striations of gypsum in lower part; few, fine and medium masses of segregated lime; calcareous; moderately alkaline.

Depth to lime ranges from 14 to 20 inches. The A horizon ranges from 5 to 8 inches in thickness and from dark grayish brown to very dark gray in color. The B2t horizons range from 9 to 16 inches in thickness. Texture of the B2t horizons commonly is clay loam, but it is loam in places. The B3ca horizon ranges from 8 to 12 inches in thickness. A few to many masses of segregated lime are in the B3ca and C1ca horizons. The C horizons are clay loam or loam in texture and in places include thin layers of sandy loam.

Houdek soils formed in similar materials as Beadle soils, but they have less clay in their B horizon than those soils. Houdek soils have a B horizon that is more clayey and they have a stronger grade of structure than the nearby Clarno soils. Houdek soils are better drained than the nearby Prosper soils, and they have thinner A and B horizons.

Houdek-Prosper loams, 0 to 2 percent slopes (HkA).—Houdek soils make up 60 percent of this complex, Prosper soils 25 percent, and other soils 15 percent. Slopes are long and smooth but are broken by ill-defined drainageways and small depressions. Houdek soils are in well-drained areas where slopes are long. Prosper soils are in slightly depressed areas along drainageways. Profiles of both soils are the ones described as representative for their respective series.

Included with these soils in mapping are areas of Clarno, Stickney, and Tetonka soils. Well-drained Clarno soils are on some of the rises. Stickney soils are along some of the drainageways and Tetonka soils are in depressions.

Most areas are farmed. Conserving moisture is the main management concern. Maintaining fertility and organic-matter content and controlling soil blowing are other concerns of management. Both soils are in capability unit IIc–2; Houdek soils are in pasture group F, windbreak group 3; Prosper soils are in pasture group K, windbreak group 1.

Houdek, Prosper and Stickney loams, 0 to 1 percent slopes (HpA).—Houdek soils make up 30 to 60 percent of the unit, Prosper soils 25 to 40 percent, and Stickney soils 15 to 30 percent. Houdek soils are dominant in most areas, Prosper soils in a few areas, and in other areas the soils are in about equal proportions. This soil complex is mainly in the south-central and northeastern parts of the county. The broad, flat-appearing areas are typically interspersed with ill-defined drainageways and a few small depressions.

Houdek soils are on the long rises. The surface layer is very dark gray and is slightly thicker than that in the profile described as representative for the Houdek series, but the two profiles otherwise are similar. Prosper soils are on the lower parts of slopes and in slightly depressed areas along drainageways. The profile is similar to that described as representative for the Prosper series. Stickney soils are on the flat slopes of the ill-defined drainageways. They have a thicker subsurface layer than the soil described as representative for the Stickney series, and visible salts are at a greater depth; but the two profiles otherwise are similar.

Included with these soils in mapping are Clarno, Dudley, and Tetonka soils. Clarno soils are on the upper parts of the slight rises. Dudley soils are intermingled with Stickney soils. Tetonka soils are in small depressions. These inclusions make up 5 to 15 percent of the mapped areas.

Most areas are farmed. Uneven growth of crops is noticeable in some years. In some years farming operations are delayed in the spring because of wetness in the low areas. The main concerns of management are conserving moisture and improving tilth. Houdek soils are in capability unit IIc–2, pasture group F, windbreak group 3; Prosper soils are in capability unit IIc–1, pasture group K, windbreak group 1; Stickney soils are in capability unit IIIs–1, pasture group E, windbreak group 4.

Houdek-Stickney loams, 0 to 2 percent slopes (HsA).—Houdek soils make up 50 percent of this complex, Stickney soils 35 percent, and other soils 15 percent. This complex is mainly in the western and southern parts of the county. In the broad, flat-appearing areas are ill-defined drainageways and low, convex undulations. Houdek soils are on the long slopes and low undulations. The profile is similar to the one described as representative for the Houdek series. Stickney soils are in the low areas and along drainageways. The profile is the one described as representative for the Stickney series.

Included with these soils in mapping are Clarno, Prosper, and Tetonka soils. Clarno soils are on some of the convex undulations. Prosper soils are on the lower end of the long slopes and in drainageways. Tetonka soils are in small depressions.

Most areas are farmed, but crop growth is uneven because of the presence of Stickney soils. The main concerns of management are conserving moisture and improving tilth. Houdek soils are in capability unit IIc–2, pasture group F, windbreak group 3; Stickney soils are in capability unit IIIs–1, pasture group E, windbreak group 4.

Lamo Series

In the Lamo series are deep, somewhat poorly drained, nearly level, calcareous, silty soils on bottom lands of the smaller streams in the county. These soils formed in alluvium.

In a representative profile the surface layer is dark-gray silt loam about 9 inches thick. Below this layer is a transitional layer of gray silt loam about 11 inches thick. It is soft when dry and very friable when moist. The underlying material is gray silty clay loam mottled with yellowish brown and brown. A buried soil of dark-gray silty clay loam is at a depth of 52 inches.

Lamo soils are high in organic-matter content and medium to high in fertility. Runoff is slow, and permeability is moderately slow. A water table rises to within 3 feet of the surface early in the growing season and recedes to 5 feet or more in summer. Lamo soils are also subject to flooding. Available water capacity is high.

The larger areas of Lamo soils are farmed. Oats, corn, alfalfa, grain sorghum, and tame grasses are the main crops. The smaller-sized areas are in native grass and are used for grazing and hay. Native grasses include prairie cordgrass, big bluestem, and switchgrass. Kentucky bluegrass makes up a larger percentage of the grass composition in many areas.

Representative profile of Lamo silt loam in a cultivated field, 2,225 feet west and 180 feet north of the SE. corner of sec. 12, T. 102 N., R. 61 W.:

Ap—0 to 5 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable; calcareous; moderately alkaline; abrupt, wavy boundary.

A12—5 to 9 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

AC1—9 to 15 inches, gray (2.5Y 5/1) silt loam, very dark grayish brown (2.5Y 3/2) when moist; few, fine, faint, olive-brown mottles; weak, medium, subangular blocky structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

AC2—15 to 20 inches, gray (2.5Y 5/1) silt loam, very dark grayish brown (2.5Y 3/2) when moist; few, fine, distinct, yellowish-brown mottles; moderate, medium, subangular blocky structure; soft, very friable; few, fine, distinct iron-manganese concretions; calcareous; moderately alkaline; gradual, irregular boundary.

C1ca—20 to 26 inches, gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) when moist; few, fine, distinct mottles of yellowish brown and brown; weak, coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few, fine and medium nests of gypsum crystals; many, fine and medium, prominent segregations of lime; calcareous; moderately alkaline; gradual, irregular boundary.

C2csca—26 to 44 inches, gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) when moist; few, fine, distinct mottles of yellowish brown and brown; weak, coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few, fine and medium nests of gypsum crystals; few, fine, distinct threads of segregated lime; calcareous; moderately alkaline; gradual, wavy boundary.

C3gca—44 to 52 inches, gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) when moist; few, fine, faint mottles of yellowish brown; massive; hard, firm, sticky and plastic; few, fine, distinct nests of gypsum crystals; many, medium, prominent masses of segregated lime; calcareous; moderately alkaline; clear, wavy boundary.

A1bg—52 to 66 inches, dark-gray (5Y 4/1) silty clay loam, black (5Y 2/1) when moist; few, fine and medium, distinct mottles of yellowish brown; massive; hard, firm, sticky and plastic; few, fine, faint nests of gypsum crystals; few, medium, distinct segregations of lime; calcareous; moderately alkaline.

The A horizons range from 8 to 15 inches in thickness, from very dark gray to dark gray in color, and from silt loam to silty clay loam in texture. The AC horizons range from 10 to 20 inches in thickness and from silt loam to silty clay loam, but in places are stratified with thin layers ranging from sand to silty clay in texture. Buried layers are at a depth of 25 inches in places.

Lamo soils are better drained and are less clayey than Clamo soils, which also are on bottom lands. They are less well drained and more silty than the nearby Bon soils. Lamo soils are better drained and less saline than the nearby Salmo soils.

Lamo silt loam (0 to 2 percent slopes) (Lo).—This soil is on bottom lands in all parts of the county. Many areas are cut into small tracts by meandering stream channels (fig. 11). The profile is the one described as representative for the series.

Figure 11.—**Area of Lamo silt loam dissected by a small stream.**

Included with this soil in mapping are Salmo soils. They are in the lower and more poorly drained areas. Also included are a few places where the surface layer is silty clay loam.

The larger areas are farmed. The smaller areas are in native grasses and are used for grazing and hay. Farm operations are delayed in some years because of wetness, and early sown crops are subject to flooding. Capability unit IIw–1; pasture group A, drained, pasture group B, undrained; windbreak group 2.

Lamo and Prosper soils, 0 to 3 percent slopes (LpA).—These soils are along streams and upland drainageways in the north-central and central parts of the county. Distinct channels are lacking or they are shallow. Both soils are present in most areas, but they vary widely in extent from one area to another. Lamo soils are in the more level areas, and Prosper soils are on the foot slopes and fans on the outer edges of the areas. Each soil has a profile similar to the one described as representative for its respective series, except that the texture of the surface layer of both soils ranges from loam to silty clay loam. Also, in places the surface layer of the Lamo soils is not calcareous, and the surface layer of the Prosper soils has been thickened by recent alluvial deposits.

Included with these soils in mapping are small areas of Enet, Salmo, and Tetonka soils. Enet soils are on the outer edges of some areas. Salmo soils are in low areas that are saline, and Tetonka soils are in small depressions.

Areas of these Lamo and Prosper soils are used as cropland and for grazing and hay. Wetness of the Lamo soil delays tillage and seeding in spring, and the areas are subject to flooding after heavy rains in summer. Lamo soils are in capability unit IIw–1, pasture group A, drained, pasture group B, undrained, windbreak group 2; Prosper soils are in capability unit IIc–1, pasture group K, windbreak group 1.

Prosper Series

In the Prosper series are deep, moderately well drained, nearly level to gently sloping, loamy soils in swales and on foot slopes on uplands. These soils formed in a thin layer of local alluvium and the underlying glacial till.

In a representative profile the surface layer is dark-gray loam about 9 inches thick. The subsoil, about 21 inches thick, is clay loam that is dark gray in the upper part, grayish brown in the middle part, and light brownish gray in the lower part. It is hard when dry and friable to firm when moist. The lower part is calcareous. The underlying material is calcareous light brownish-gray clay loam. It is mottled with gray and olive yellow.

Prosper soils are high in organic-matter content and in fertility. Runoff is slow to medium, and permeability is moderate in the subsoil and moderately slow in the underlying material. Most areas receive runoff from adjacent soils. Available water capacity is high.

Most areas are farmed. Prosper soils are well suited to all crops commonly grown in the county. A few areas are in native grasses and are used for grazing and hay. Native grass species include switchgrass, big bluestem, blue grama, and buffalograss. Kentucky bluegrass is present in many areas.

Representative profile of Prosper loam in an area of Houdek-Prosper loams, 0 to 2 percent slopes, in a plowed field, 1,860 feet north and 208 feet west of the SE. corner of sec. 21, T. 101 N., R. 61 W.:

Ap—0 to 6 inches, dark-gray (10YR 4/1) crushing to dark grayish-brown (10YR 4/2) loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; weak, fine, granular structure; slightly hard, friable; neutral; abrupt, wavy boundary.

A12—6 to 9 inches, dark-gray (10YR 4/1) crushing to dark grayish-brown (10YR 4/2) loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium and fine, granular; slightly hard, friable; neutral; clear, wavy boundary.

B21t—9 to 18 inches, dark-gray (10YR 4/1) crushing to dark grayish-brown (10YR 4/2) clay loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, blocky; hard, friable, sticky and slightly plastic; thin, continuous clay films on all faces of peds; neutral; clear, wavy boundary.

B22t—18 to 24 inches, grayish-brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) when moist; dark grayish-brown (10YR 4/2) coatings on faces of some peds; moderate, medium, prismatic structure; hard, firm, sticky and plastic; thin, continuous clay films on all faces of peds; mildly alkaline; clear, wavy boundary.

B3ca—24 to 30 inches, light brownish-gray (2.5Y 6/3) clay loam, olive brown (2.5Y 4/3) when moist; weak, medium, prismatic structure that parts to weak, medium, blocky; hard, friable, sticky and plastic; thin, patchy clay films on vertical faces of peds; few, fine, faint masses of segregated lime; calcareous; moderately alkaline; gradual boundary.

C1ca—30 to 45 inches, light brownish-gray (2.5Y 6/3) clay loam, grayish brown (2.5Y 5/3) when moist; few, fine, faint, gray mottles; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; many, medium and coarse masses of segregated lime; calcareous; strongly alkaline; diffuse boundary.

C2—45 to 66 inches, light brownish-gray (2.5Y 6/3) clay loam, dark grayish brown (2.5Y 4/3) when moist; many, coarse, distinct mottles of gray (2.5Y 6/1) and olive yellow (2.5Y 6/6), dark gray (2.5Y 4/1) and olive brown (2.5Y 4/4) when moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; common, fine, very dark grayish-brown iron-manganese concretions; few, fine and medium masses of segregated lime; calcareous; strongly alkaline.

The A horizons range from 7 to 10 inches in thickness and from dark gray to dark grayish brown in color. Texture commonly is loam, but it ranges from loam to light silty clay loam. The B2t horizons range from 13 to 20 inches in thickness and from dark gray to grayish brown in color. Texture of the B2t horizons generally is clay loam, but includes some silty clay loam in places. The B3ca horizon ranges from 4 to 8 inches in thickness. The C1ca horizon ranges from 8 to 16 inches in thickness. Reaction ranges from slightly acid to mildly alkaline in the A and B2t horizons and from moderately to strongly alkaline in the C horizons. In places a few to common nests of gypsum are in the lower part below the lime accumulation layers.

Prosper soils have thicker A and B2t horizons than the nearby Houdek soils. They lack an A2 horizon and have less clayey B horizons than Stickney soils which formed from similar materials.

Prosper silt loam, 0 to 3 percent slopes (PrA).—This soil occupies foot slopes and fans below steep slopes along the James River and other streams. Areas are long and narrow, and slopes are plane to concave. The profile is similar to the one described as representative for the series, except that the surface layer is silt loam and the subsoil is somewhat more clayey in places. Also, in a few places, siltstone is in the underlying material at a depth below 40 inches.

Included with this soil in mapping are Clamo and Lamo soils where the areas join with bottom lands. In places these inclusions make up as much as 20 percent of the mapped areas.

Some areas are cultivated and some are used for hay. Crop growth is benefited by additional moisture received as runoff from adjacent soils. Conserving moisture is the main concern of management. Capability unit IIc-1; pasture group K; windbreak group 1.

Prosper silt loam, 3 to 6 percent slopes (PrB).—This soil occupies foot slopes and fans adjacent to bottom lands of the James River and other streams. Slopes are long and smooth. In places the areas are dissected by drainage channels from adjacent steep soils. The surface layer is silt loam and the subsoil is somewhat more clayey than in the profile described as representative for the series, but the two profiles otherwise are similar.

Included with this soil in mapping are Blendon, Clamo, Clarno, and Lamo soils. Clamo and Lamo soils are on the lower slopes adjacent to the bottom lands. Blendon and Clarno soils are on the upper slopes of some areas. These inclusions make up 15 percent of the mapped areas.

These soils are used for crops and for hay. Controlling water erosion is the main concern of management. Capability unit IIe-3; pasture group K; windbreak group 1.

Redstoe Series

In the Redstoe series are moderately deep, well-drained, nearly level to hilly, calcareous, loamy soils on uplands. These soils formed in a thin mantle of reworked material of glacial origin and in material weathered from the underlying siltstone.

In a representative profile the surface layer is very dark grayish-brown loam about 9 inches thick. The subsoil is pale-brown silt loam about 6 inches thick. It is slightly hard when dry and very friable when moist. The underlying material is very pale brown silt loam containing fragments of siltstone. Bedded siltstone is at a depth of 32 inches.

Redstoe soils are moderate in organic-matter content and low in fertility. Runoff is medium to rapid, and permeability is moderate. Available water capacity is low.

Some areas are cultivated. Small grains, corn, sorghums, alfalfa, and tame grasses are the crops grown. Most areas are in native grasses and are used for grazing and hay. Native grass species include little bluestem, side-oats grama, blue grama, and buffalograss.

Representative profile of Redstoe loam, 0 to 3 percent slopes, in native grass, 2,145 feet south and 285 feet east of the NW. corner of sec. 22, T. 102 N., R. 61 W.:

A11—0 to 4 inches, very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; soft, very friable; calcareous; moderately alkaline; clear, wavy boundary.

A12—4 to 9 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; slightly hard, very friable; calcareous; moderately alkaline; clear, wavy boundary.

B2—9 to 15 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, very friable; few, dark-brown organic stains on vertical faces of peds in upper part; few fragments of soft siltstone; calcareous; moderately alkaline; clear, wavy boundary.

C1ca 15 to 23 inches, very pale brown (10YR 7/4) silt loam, yellowish brown (10YR 5/4) when moist; few, fine, faint mottles of strong brown; weak, medium, subangular blocky structure; slightly hard, very friable; few, fine fragments of soft siltstone; calcareous; moderately alkaline; gradual, wavy boundary.

C2ca 23 to 28 inches, very pale brown (10YR 7/4) and light yellowish-brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) when moist; few, fine, faint mottles of strong brown; very weak, medium and coarse, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, very friable; few, fine striations of crystalline salts; calcareous; moderately alkaline; gradual, wavy boundary.

C3—28 to 32 inches, very pale brown (10YR 7/4) silt loam, yellowish brown (10YR 5/5) when moist; massive; slightly hard, very friable; many fragments of soft siltstone; calcareous; moderately alkaline; gradual boundary.

C4—32 to 44 inches, very pale brown (10YR 8/4) bedded siltstone, brownish yellow (10YR 6/6) when moist; hard, friable; many seams and streaks of gypsum between fracture planes.

In places the entire profile formed in the underlying siltstone. A few to many fragments of siltstone and a few rounded pebbles of igneous origin are in the solum. The A horizons range from 7 to 10 inches in thickness, from very

dark gray to grayish brown in color, and from loam to silt loam in texture. The B2 horizon ranges from 4 to 6 inches in thickness, from grayish brown to pale brown in color, and from loam to silt loam in texture. Gypsum segregations range from a few to many in the C2ca horizon. Depth to bedded siltstone ranges from 22 to 40 inches. The siltstone is soft and easily penetrated, but it becomes hard and brittle when exposed to air.

Redstoe soils have a thicker A horizon and are deeper over siltstone than the nearby Gavins soils. Their profile resembles that of the Ethan soils, but it is underlain by bedded siltstone at a depth of less than 40 inches.

Redstoe loam, 0 to 3 percent slopes (ReA).—This soil is on uplands near Firesteel Creek and Enemy Creek. Slopes are short, irregular, and plane to convex. The profile is the one described as representative for the series, except that in a few places the surface layer is thicker and less calcareous. Also, the surface layer is silt loam in a few places where the thin mantle of glacial till is absent.

Included with this soil in mapping are Clarno and Ethan soils. They are in places where the mantle of glacial till is 40 inches or more in thickness over the siltstone. These inclusions make up about 15 percent of the mapped areas.

Most areas are farmed. Small areas are in native grasses and are used for grazing. Crop growth is affected by the high-lime content and the low fertility. The main concerns of management are improving organic-matter content and fertility and controlling soil blowing. Capability unit IVs–3; pasture group G; windbreak group 8.

Redstoe loam, 3 to 9 percent slopes (ReC).—This soil is on uplands in the north central and central parts of the county. Slopes are short, irregular, and convex. The profile is similar to the one described as representative for the series, except that in places the surface layer is silt loam.

Included with this soil in mapping are Clarno and Ethan soils. They are in places where the mantle of glacial till over siltstone is 40 inches or more. These inclusions make up less than 15 percent of the mapped areas.

Most areas are cultivated. A few areas are in native grasses and are used for grazing. Crop growth is affected by the high content of lime and by the low fertility of this soil. Controlling water erosion and soil blowing is the main concern of management. Improving organic-matter content and fertility are other management concerns. Capability unit IVe–2; pasture group G; windbreak group 8.

Redstoe loam, 9 to 21 percent slopes (ReD).—This soil is on stream breaks adjacent to Firesteel Creek and Enemy Creek. Slopes are short and convex. Many small drains cut through the areas. The surface layer is thinner and depth to siltstone is less than in the profile described for the series, and in places the surface layer is silt loam. The two profiles otherwise are similar.

Included with this soil in mapping are Betts, Ethan, and Gavins soils. Betts and Ethan soils are in pockets where the glacial till mantle is more than 40 inches thick over siltstone. Gavins soils are on the crests of ridges. These inclusions make up about 20 percent of the mapped areas.

Most areas are in native grasses and are used for grazing. This soil is too steep for cultivation. Capability unit VIe–1; pasture group G; windbreak group 10.

Salmo Series

In the Salmo series are deep, poorly drained, nearly level, calcareous, silty soils on bottom lands. These soils formed in alluvium.

In a representative profile the surface layer is very dark gray silt loam about 13 inches thick and has fine segregations of salts. Below this is a transitional layer, about 11 inches thick, of dark-gray silty clay loam. The underlying material is gray silty clay loam.

Salmo soils are high in content of organic matter. Fertility is medium to low depending on the amount of salts in the soil. Runoff is very slow and permeability is moderately slow. Salmo soils are subject to frequent flooding and have a water table that is at or within 2 feet of the surface during spring.

Most areas are in native grasses and are used for grazing and hay. Native grasses include switchgrass, western wheatgrass, prairie cordgrass, and inland saltgrass. Kentucky bluegrass is prominent in many areas.

Representative profile of Salmo silt loam, in native grass, 1,625 feet west and 750 feet south of the NE. corner of sec. 14, T. 102 N., A. 62 W.:

A11sa—0 to 5 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; moderate, fine and very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; abundant, fibrous roots; common, fine segregations of salts; calcareous; moderately alkaline; clear, wavy boundary.

A12sa—5 to 13 inches, very dark gray (2.5Y 3/1) silt loam, black (2.5Y 2/1) when moist; weak, medium and fine, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; plentiful, fibrous roots; common, fine segregations of salts; calcareous; moderately alkaline; clear, wavy boundary.

AC—13 to 24 inches, dark-gray (2.5Y 4/1) silty clay loam, black (2.5Y 2/1) when moist; few, fine, faint mottles of light olive brown; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few, fibrous roots; few, distinct nests of gypsum crystals; few, fine, faint segregations of lime; calcareous; moderately alkaline; gradual, wavy boundary.

C1gcacs—24 to 37 inches, gray (N 5/0) silty clay loam, very dark gray (5Y 3/1) when moist; common, fine, distinct mottles of light olive brown and dark yellowish brown; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few, fine roots; few, fine and medium nests of gypsum crystals; common, fine, distinct threads of segregated lime; calcareous; moderately alkaline; gradual, wavy boundary.

C2gcs—37 to 47 inches, gray (N 5/0) silty clay loam, very dark gray (5Y 3/1) when moist; few, medium, distinct mottles of light olive brown and dark yellowish brown; massive; hard, firm, sticky and plastic; few, fine roots; common, fine, distinct nests of gypsum crystals; calcareous; moderately alkaline; clear, wavy boundary.

C3gca—47 to 60 inches, gray (N 5/0) silty clay loam, very dark gray (5Y 3/1) when moist; massive; hard, firm, sticky and plastic; few, fine nests of gypsum crystals; common, coarse, distinct segregations of lime; calcareous; moderately alkaline.

Combined thicknes of the A horizons ranges from 11 to 25 inches. Texture commonly is silt loam, but it is silty clay loam in places. Salt segregations in the A horizons range from few to many. The AC horizon ranges up to 15 inches in thickness but is absent in some profiles. The C horizons below a depth of 40 inches commonly are stratified with thin

layers ranging from sand to silty clay textures. Buried A horizons are in some profiles.

Salmo soils are similar to the nearby Lamo soils, but they have visible segregations of salts in the A horizons. They are less clayey than Clamo soils, and they contain more salts than those soils, which also are on bottom lands.

Salmo silt loam (0 to 2 percent slopes) (Sa).—This is the only Salmo soil mapped in the county. It is on bottom lands of the smaller streams. The areas are subject to flooding and the water table rises to within 2 feet of the surface during the spring months. In places the surface layer is silty clay loam.

Included with this soil in mapping are areas of Firesteel and Lamo soils. Firesteel soils are on fan slopes on the outer edges of the areas. Lamo soils are on slightly better-drained, higher levels within the areas. These inclusions make up less than 20 percent of the mapped areas.

Most areas are in native grasses and are used for hay and pasture. A few areas are farmed and most of them are in tame grass. Capability unit IVw-1; pasture group J; windbreak group 10.

Stickney Series

In the Stickney series are deep, moderately well drained, nearly level, loamy soils. These soils formed in glacial till on uplands.

In a representative profile the surface layer is dark-gray loam about 7 inches thick. The subsurface layer is gray silty clay loam about 3 inches thick. Below this layer is a transitional layer of very dark gray silty clay loam about 3 inches thick. The subsoil, about 21 inches thick, is clay loam. It is very dark gray in the upper part, grayish brown in the middle part, and light olive brown in the lower part. Nests of gypsum crystals are in the lower part. The underlying material is calcareous light yellowish-brown and light-gray clay loam.

Stickney soils are moderate in organic-matter content and medium in fertility. Runoff is slow, and permeability is slow. Available water capacity is high.

Most areas are cultivated. Small grains, sorghums, alfalfa, and tame grasses are the main crops.

Representative profile of a Stickney loam in an area of Houdek-Stickney loams, 0 to 2 percent slopes, in a cultivated field, 370 feet west and 180 feet north of the SE. corner of sec. 24, T. 101., R. 62 W.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) crushing to dark grayish brown (10YR 4/2) loam, black (10YR 2/1) when moist; weak, medium and fine, subangular blocky structure; hard, friable; slightly acid; abrupt, smooth boundary.

A2—7 to 10 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) when moist; weak, medium and fine, subangular blocky structure; slightly hard, friable; slightly acid; clear, wavy boundary.

B&A—10 to 13 inches, very dark gray (10YR 3/1) silty clay loam (B), black (10YR 2/1) when moist, and gray (10YR 5/1) bleached sand grains (A), very dark gray (10YR 3/1) when moist; weak, medium, prismatic structure that parts to moderate, medium and fine, blocky; hard, friable, sticky and plastic; slightly acid; clear, wavy boundary.

B21t—13 to 17 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, blocky; very hard, firm, sticky and plastic; thin, nearly continuous clay films on all faces of peds; neutral; clear, wavy boundary.

B22t—17 to 21 inches, very dark grayish-brown (2.5Y 3/2) clay loam, black (2.5Y 2/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, blocky; very hard, very firm, sticky and plastic; thin, continuous clay films on all faces of peds; neutral; clear, wavy boundary.

B23t—21 to 24 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; patchy coatings on peds of very dark gray (2.5Y 3/1) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, very firm, sticky and plastic; thin, continuous clay films on vertical faces of peds; neutral; clear, smooth boundary.

B31cs—24 to 29 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, sticky and plastic; thin, patchy clay films on all faces of peds; many, fine nests of gypsum crystals; moderately alkaline; clear, wavy boundary.

B32cs—29 to 34 inches, light olive-brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, sticky and plastic; few, fine iron-manganese concretions; many, fine nests and striations of gypsum crystals; moderately alkaline; clear, wavy boundary.

Cca—34 to 60 inches, light yellowish-brown (2.5Y 6/3) and light-gray (2.5Y 7/1) clay loam, light olive brown (2.5Y 5/3) and light yellowish brown (2.5Y 6/3) when moist; few, fine, prominent mottles of strong brown; very weak, coarse, blocky structure; hard, friable, sticky and plastic; few, very fine iron-manganese concretions; few, fine nests of gypsum crystals; many masses and seams of segregated lime; calcareous; strongly alkaline.

Depth to lime ranges from 20 to 40 inches. Reaction ranges from slightly acid to mildly alkaline in the A and B2t horizons and from moderately to strongly alkaline in the C horizon. The Ap horizon ranges from 6 to 9 inches in thickness and from dark gray to dark grayish brown in color. The A2 horizon ranges from 2 to 4 inches in thickness and from dark gray to light brownish gray in color. Weak, platy structure occurs in places. The B&A horizon ranges from 1 to 4 inches in thickness. Texture of the A horizons and the B&A horizon ranges from loam to silty clay loam. Combined thickness of the B2t horizons ranges from 6 to 14 inches. These horizons have moderate to strong structure and range from clay loam to clay in texture. The B3 horizons range from 5 to 10 inches in thickness, and they have few to many, fine to medium nests of gypsum crystals. Texture of the C horizons ranges from clay loam to loam, which is firm to friable when moist.

Stickney soils are in complex with, or in areas near, Beadle, Dudley, Houdek, Prosper, and Tetonka soils. They have a slightly thicker A horizon than Dudley soils, which lack a B&A horizon. Beadle, Houdek, and Prosper soils lack an A2 horizon, and Stickney soils have a more clayey B2t horizon than Houdek and Prosper soils. Stickney soils are better drained than Tetonka soils, and they have more sodium in the B2t horizon than those soils.

Stickney-Dudley complex, 0 to 2 percent slopes (SdA).—Stickney soils make up 65 percent of this complex, Dudley soils 20 percent, and other soils 15 percent. The soils in this complex are on uplands in the west-central part of the county. Within the broad slightly depressed areas are ill-defined drainageways and small dips. Dudley soils are in these small dips scattered through the areas and are closely intermingled with Stickney soils. The profiles of both soils are the ones described as representative for their respective series.

Included with this complex in mapping are Beadle and Houdek soils. They are on small rises within the area.

Most areas are farmed. Small grains, sorghums, alfalfa, and tame grasses are the main crops. A few small areas are in native grass and are used for grazing. Crop growth is affected by the claypan in the subsoil. Concerns of management include the improvement of tilth and the maintenance of organic-matter content and fertility. Stickney soils are in capability unit IIIs–1, pasture group E, windbreak group 4; Dudley soils are in capability unit IVs–1, pasture group C, windbreak group 9.

Storla Series

In the Storla series are moderately well drained to somewhat poorly drained, nearly level, calcareous, loamy soils that are moderately deep over sand and gravel. These soils are on uplands and formed in loamy, glacial melt-water deposits over sand and gravel.

In a representative profile the surface layer is very dark gray loam about 10 inches thick. Below this layer is a transitional layer of dark-gray loam about 6 inches thick. It is slightly hard when dry and friable when moist. In it are spots of lime that extend into the underlying material. The underlying material is gray loam in the upper part, light brownish-gray loamy coarse sand and gravel in the middle part, and grayish-brown sand and gravel below a depth of 42 inches.

Storla soils are moderate in organic-matter content and are low in fertility. Runoff is slow. Permeability is moderate to a depth of 30 inches and rapid in the underlying sand and gravel. In spring the water table is at a depth of 3 to 5 feet, and it recedes to a depth of 5 feet or more in summer. Available water capacity is low to moderate.

Most areas are cultivated. Alfalfa and corn are the main crops. Oats, sorghums, and tame grasses are also grown. Small areas are in native grasses and are used for grazing and hay. Native grass species include switchgrass, needle-and-thread, inland saltgrass, and blue grama. Kentucky bluegrass is also present in many areas.

Representative profile of Storla loam, 0 to 2 percent slopes, in a cultivated field, 760 feet west and 450 feet north of the SE. corner of sec. 5, T. 103 N., R. 61 W.:

Ap—0 to 5 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) when moist; weak, medium and fine, granular structure; soft, very friable; calcareous; moderately alkaline; abrupt, wavy boundary.

A12—5 to 10 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) when moist; weak, coarse and medium, subangular blocky structure; slightly hard, friable; a few, fine segregations of lime; calcareous; moderately alkaline; clear, wavy boundary.

ACca—10 to 16 inches, dark-gray (10YR 4/1) loam, very dark gray (10YR 3/1) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, slightly sticky; common, fine and medium segregations of lime; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—16 to 30 inches, gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, slightly sticky; many, medium and coarse segregations of lime; calcareous; strongly alkaline; clear, wavy boundary.

IIC2—30 to 42 inches, light brownish-gray (2.5Y 6/2) loamy coarse sand and gravel, dark grayish brown (2.5Y 4/2) when moist; single grained; loose; few, fine iron-manganese concretions; thick crusts of lime on gravel; calcareous; moderately alkaline; diffuse boundary.

IIC3—42 to 66 inches, grayish-brown (2.5Y 5/2) sand and gravel, dark grayish brown (2.5Y 4/2) when moist; single grained; loose; calcareous; moderately alkaline.

The A horizons range from 6 to 10 inches in thickness and from very dark gray to dark gray in color. The ACca horizon is 6 inches or less in thickness and is absent in some profiles. The C1ca horizon ranges from 14 to 24 inches in thickness, and in places it has segregated gypsum crystals. Segregations of lime range from few to many in the ACca and C1ca horizons. Depth to sand and gravel ranges from 20 to 40 inches.

Storla soils have a coarser textured C horizon than Davison soils, which are in similar positions. They formed in similar material as the well-drained Enet soils, but are more calcareous than those soils. Storla soils are slightly better drained and are less sandy than Fedora soils.

Storla loam, 0 to 2 percent slopes (SoA).—This soil is on uplands that represent glacial melt-water channels. Within the areas are ill-defined drainageways interspersed with small convex rises. The profile is the one described as representative for the series, except that in the southeastern part of the county depth to sand and gravel is somewhat greater, and in places the surface layer is silt loam.

Included with this soil in mapping are Blendon and Enet soils. They are on the rises and make up as much as 30 percent of the mapped areas.

Most areas are farmed, but the fertility of this soil is affected by the high-lime content. Wetness during spring in some years delays seeding and tillage, but the soil is droughty in dry years. Capability unit IIIs–3; pasture group A; windbreak group 2.

Storla complex, 0 to 2 percent slopes (StA).—Storla soils make up 40 to 70 percent of this complex, an unnamed soil that has a claypan 15 to 25 percent, and other soils 15 to 35 percent. This complex is in the east-central part of the county. In the areas are ill-defined drainageways and narrow riser-steps from one level to another. The profile of the Storla soils is similar to the one described as representative for the Storla series, except that in places it is more silty and contains salts in the underlying material above the sand and gravel. The soil that has a claypan is in low spots scattered through the areas, and, like the Storla soils, it is underlain by sand and gravel.

Included with this complex in mapping are Blendon and Enet soils. They are on the narrow rises from one level to another, on small convex humps, and on the outer edges of some areas.

Most areas are in native grasses, or have been seeded to tame grass and are used for grazing and hay. Crop growth is affected by the high-lime content of the Storla soils. Wetness is a concern of management in some years, but these soils are droughty in dry years. Capability unit IIIs–3; pasture group A; windbreak group 2.

Tetonka Series

In the Tetonka series are deep, somewhat poorly drained, nearly level, silty soils that have a clayey subsoil. These soils formed in alluvium washed in from adjacent soils and are in depressions on uplands.

In a representative profile the surface layer is dark-gray silt loam about 8 inches thick. The subsurface layer is gray silt loam about 6 inches thick. Below this layer is a thin transitional layer, about 2 inches thick, of gray silty clay loam. The subsoil, which extends to a depth of 56 inches, is dark-gray clay in the upper part and olive-gray and gray clay loam in the lower part. The upper part is extremely hard when dry and firm to very firm when moist. The underlying material is calcareous light-gray clay loam.

Tetonka soils are moderate in organic-matter content and medium in fertility. Runoff ponds in these soils and permeability is very slow. Available water capacity is moderate to high.

Some areas are cultivated. Other areas are in native grasses and are used for grazing and hay. Native vegetation includes sedges, western wheatgrass, and buffalograss.

Representative profile of Tetonka silt loam, 0 to 2 percent slopes, in native grass, 1,105 feet west and 207 feet north of the SE. corner of sec. 26, T. 101 N., R. 60 W.;

A1—0 to 8 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; few, fine, faint mottles of brownish yellow; weak, thin, platy structure that parts to weak, fine and medium, granular; slightly hard, very friable; few, fine masses and concretions of iron-manganese; slightly acid; clear, irregular boundary.

A2—8 to 14 inches, gray (10YR 5/1 and 6/1) silt loam, very dark gray (10YR 3/1) when moist; common, medium mottles of brownish yellow (10YR 6/6); weak, thin, platy structure parting to weak, fine, granular; soft, very friable; common, fine and very fine pores; common, medium, soft masses and common, fine concretions of iron-manganese; slightly acid; clear, wavy boundary.

A&B—14 to 16 inches, gray (10YR 5/1 and 6/1) silty clay loam, very dark gray (10YR 3/1) when moist; many, medium, prominent mottles of brownish yellow (10YR 6/6); weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few masses and common, fine and medium concretions of iron-manganese; slightly acid; clear, smooth boundary.

B21t—16 to 22 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; weak, medium and coarse, prismatic structure that parts to moderate, fine and medium, subangular blocky; extremely hard, firm, sticky and plastic; thin, continuous clay films on vertical faces of peds; few, fine iron-manganese concretions; neutral; gradual boundary.

B22t—22 to 44 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; extremely hard, very firm, sticky and plastic; thin, patchy clay films on faces of peds; few, fine iron-manganese concretions; neutral; gradual boundary.

B31—44 to 50 inches, light olive-gray (5Y 6/2) clay loam, dark gray (5Y 4/1) and olive gray (5Y 4/2) when moist; few, medium, distinct mottles of light brownish gray (2.5Y 6/2); moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; thin, continuous clay films; few, fine iron-manganese concretions; moderately alkaline; gradual boundary.

B32—50 to 56 inches, gray (5Y 6/1) and light olive-gray (5Y 6/2) clay loam, dark gray (5Y 4/1) and olive gray (5Y 4/2) when moist; common, medium, distinct mottles of brownish yellow (10YR 6/6) and light yellowish brown (2.5Y 6/4); moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; few, fine iron-manganese concretions; moderately alkaline; clear, wavy boundary.

Cca—56 to 66 inches, light-gray (5Y 7/1 and 7/2) clay loam, gray (5Y 5/1) and olive gray (5Y 5/2) when moist; many, medium, distinct mottles of brownish gray (10YR 6/6); thick, platy structure; hard, firm, sticky and plastic; few, medium iron-manganese concretions; few segregations of lime; calcareous; moderately alkaline.

Depth to lime ranges from 24 to more than 60 inches. Reaction ranges from slightly acid to neutral in the A horizons and from neutral to moderately alkaline in the B horizons. The A1 horizon ranges from 6 to 12 inches in thickness, from dark gray to very dark gray in color and from silt loam to silty clay loam in texture. A few to many, faint to prominent mottles are in the A1 horizon. The A2 horizon ranges from 4 to 10 inches in thickness and from loam to silty clay loam in texture. Platy structure in the A2 horizon ranges from weak to moderate and from thin to thick. The A&B horizon is as much as 4 inches in thickness, but it is absent in some profiles. The B2t horizons range from 10 to 32 inches in thickness and from dark gray to grayish brown in color. Texture commonly is clay, but it is clay loam, silty clay loam, or silty clay in places. The B3 horizons range from 4 to 16 inches in thickness. The C horizons range from clay loam to clay in texture and in places are stratified with sand and gravel.

Tetonka soils are similar to the better drained Stickney soils, but they have thicker B horizons that contain less sodium than those soils.

Tetonka silt loam, 0 to 2 percent slopes (TeA).—This soil is on uplands in enclosed depressions and in broad, slightly depressed areas. The profile is the one described as representative for the series. The thickness of the surface, subsurface, and subsoil layers varies from one area to another.

Included with this soil in mapping are Dudley, Prosper, and Stickney soils. Dudley and Stickney soils are on the outer parts of the areas. Prosper soils are on fan slopes on the outer edges of the areas. These inclusions make up 10 percent or less of the mapped areas.

This soil is used for crops, pasture, and hay. Generally, this soil is wet during some part of the growing season. Planting is often delayed in spring. In some years crops are drowned when runoff water is ponded after heavy rains in summer (fig. 12). If adequately drained, this soil is suited to all crops commonly grown in the county. The main concerns of management are improving drainage and tilth and maintaining fertility and organic-matter content. Capability unit IIw-2; pasture group A, drained, pasture group B, undrained; windbreak group 10.

Tetonka-Stickney complex, 0 to 3 percent slopes (TsA).—Tetonka soils make up 45 percent of this complex, Stickney soils 40 percent, and other soils 15 percent. The areas are broad, flat-bottomed drainageways on uplands. Slopes are mostly less than 2 percent except for slight rises on the edges of the areas. Tetonka soils are in the lower, depressed areas where water tends to pond. Their surface and subsurface layers contain fewer mottles than in the profile described as representative for the Tetonka series, but the profiles otherwise are similar. Stickney

Figure 12.—**Aerial view of Tetonka silt loam, 0 to 2 percent slopes. In many places crops growing on this soil have been drowned by ponded water.**

soils are on the higher and better drained slopes of the drainageways. Their profile is similar to the one described as representative for the Stickney series.

Included with this complex in mapping are Dudley and Prosper soils. Dudley soils are closely intermingled with Stickney soils. Prosper soils are on the outer edges of the mapped areas.

Most areas of the complex are farmed. Corn, sorghums, small grains, alfalfa, and tame grasses are suited if the areas are adequately drained. Alfalfa and tame grasses are better suited than other crops because of wetness. The main concerns of management are improving drainage and tilth and maintaining fertility and organic-matter content. Tetonka soils are in capability unit IIw-2, pasture group A, drained, pasture group B, undrained, windbreak group 10; Stickney soils are in capability unit IIIs-1, pasture group E, windbreak group 4.

Use and Management of the Soils

This section discusses the use and management of the soils for crops, for pasture, for windbreaks, for wildlife, for engineering uses, and for town and country planning. A table is provided that shows predicted average yields under two levels of management on the soils suitable for crops.

General Management of Cropland [2]

About 70 percent of Davison County is cropland. Corn is the main crop, but oats, alfalfa, sorghums, and tame grasses are also commonly grown.

Management practices needed on all the cultivated soils in the county are ones that conserve moisture, control water erosion and soil blowing, and maintain or improve tilth, fertility, and organic-matter content of the soils. Proper utilization of crop residue protects these soils from soil blowing and water erosion, and conserves moisture. Using a cropping system that improves the soils will help to improve tilth, fertility, and content of organic matter on all the cultivated soils. These practices alone keep soil losses to a minimum and help to conserve moisture on the Bon, Clarno, Houdek, Prosper, and other nearly level soils. Other practices that help to control

[2] By WALTER N. PARMETER, agronomist, Soil Conservation Service.

water erosion and that conserve moisture on gently undulating and undulating soils, such as the Clarno, Ethan, and Houdek, are contour farming, contour stripcropping, terraces, and grassed waterways.

Stubble mulching is a system of managing crop residue during preparation of the seedbed, planting, cultivation, and after harvest so that a protective cover is kept on the surface the year round. It conserves moisture and is effective in reducing soil blowing on the Blendon, Delmont, Enet, Fedora, and similar soils. Stubble mulching also helps to control water erosion, and is an excellent alternative practice to use on undulating soils where terraces and contouring are difficult to apply because of the irregularity of the slopes.

Wind stripcropping is the practice of alternating strips of close-growing crops with strips of row crops or fallow. It helps to control soil blowing on the Blendon, Fedora, and similar soils.

Emergency tillage consists of roughening the soil surface by listing, ridging, duckfooting, or chiseling for temporary control of soil blowing. It is an effective practice where the soil does not have an adequate cover of crop residue or growing plants to protect it from blowing. Emergency tillage is most likely to be needed on the Blendon, Davison, Fedora, Firesteel, and Redstoe soils, but it may be needed on many of the other soils if those soils are cultivated during dry years.

Among practices that improve tilth and that increase the content of organic matter in the soils are proper utilization of crop residue, stubble mulching, and use of animal manure and green-manure crops. Plowing under sweetclover as a green-manure crop helps to improve tilth of the Dudley, Stickney, and similar soils.

Frequent tillage of such soils as the Beadle, Prosper, and Stickney leads to the formation of a tillage pan or traffic pan just below plow depth. Formation of a pan can be avoided by working the soils only when they are dry enough to be cultivated without damage and by alternating the depth of tillage. Existing pans can be broken by chiseling every third or fourth year and by including deep-rooted legumes in the cropping system.

Many of the soils in the county lack a balanced supply of plant nutrients. Essential plant nutrients, such as nitrogen and phosphorus, are most likely to be lacking in soils that are high in content of lime, for example the Davison, Fedora, Firesteel, Redstoe, and Storla. Additional nitrogen generally is needed where a large amount of crop residue has been incorporated into the surface layer. A deficiency in nitrogen is most likely to be apparent during and immediately after a year of above-average rainfall. Soil tests help to determine the kinds and amounts of fertilizer needed for a specific crop in a given field.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in Davison County.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. (None in Davison County.)

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have limitations that restrict their use largely to pasture, range woodland, wildlife, or recreation.

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CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-3 or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

In the following pages each of the capability units in Davison County is described, and suggestions for the use and management of the soils in each unit are given. The names of the soil series are mentioned in the description of each unit, but this does not mean that all the soils in a given series are in the unit. Also, if a soil is a member of a mapping unit complex, its capability is likely to differ from the capability unit when the soil is mapped alone. This is because the complex of soil is treated as a whole in its management for cropland. The capability classification of each individual soil is given in the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT IIe-1

Davison-Hand loams, 0 to 2 percent slopes, are the only soils in this capability unit. The surface layer and the subsoil of both soils are loam. The dominant Davison soil is high in content of lime and is moderately well drained or somewhat poorly drained.

These soils are easily worked. They have moderate permeability and moderate to high available water capacity. Runoff is slow to medium. Organic-matter content is moderate, and fertility is medium to low. Availability of phosphorus is affected by the high content of lime in the Davison soil. Controlling soil blowing, maintaining organic-matter content, and improving fertility are concerns of management.

Corn, oats, sorghum, alfalfa, and tame grasses are the main crops.

Utilizing crop residue, adding animal manure, and growing green-manure crops improve the fertility and helps to maintain the organic-matter content of the soils. Stubble mulching and wind stripcropping helps to control soil blowing and to conserve moisture.

CAPABILITY UNIT IIe-2

This unit consists of deep, gently undulating, well-drained soils of the Clarno, Ethan, Hand, and Houdek series. These soils have a loam surface layer and a subsoil of loam or clay loam.

These soils are easily worked. Permeability is moderate, available water capacity is moderate to high, and runoff is medium. Content of organic matter is moderate, and fertility is medium to high, except in the Ethan soils. Ethan soils are moderately low in content of organic matter and medium to low in fertility. Some areas are eroded. Controlling water erosion is the main problem of management.

Corn, sorghums, oats, alfalfa, and tame grasses are the main crops.

Using crop residue, conservation rotations, and contour farming helps to control water erosion. Contour stripcropping, terraces, and grassed waterways also help to control erosion. Where slopes are too irregular for terraces, waterways, and farming on the contour, the use of close-growing crops and stubble mulching helps to control water erosion.

CAPABILITY UNIT IIe-3

Prosper silt loam, 3 to 6 percent slopes, is the only soil in this unit. The subsoil is clay loam. This soil receives runoff from steeper adjacent soils.

This soil has good tilth and is easy to work. Runoff is medium, and permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity, content of organic matter, and fertility are high. Controlling water erosion is the main concern of management.

Corn, oats, sorghums, and alfalfa are the main crops. All crops common to the county are suitable.

Use of crop residue, conservation rotations, and contour farming helps to control erosion. Terraces and contour stripcropping will also help control erosion.

CAPABILITY UNIT IIw-1

This unit consists of deep, poorly drained and somewhat poorly drained, calcareous soils of the Clamo and Lamo series on bottom lands.

These soils are high in content of organic matter and medium to high in fertility. Available water capacity is high, permeability is slow and moderately slow, and runoff is slow. Wetness from flooding and the rise of the water table often delays seeding and tillage in spring. Control of excess water is the main concern of management.

If adequately drained, these soils are suited to all crops common to the county. Crop selection in many areas is limited to crops that can be planted late or to such crops as alfalfa and tame grasses that can survive short periods of flooding. Early-maturing varieties of silage corn and forage sorghums are suitable late-planted crops. Where drainage is not provided, these soils are better suited to pasture and hay.

Shallow open drains help to remove trapped water. Drainage ditches and tile drains help to regulate the level of the water table in places where it is high. Using crop residue, green manure crops, and animal manure helps to improve tilth and to maintain the content of organic matter and fertility.

CAPABILITY UNIT IIw-2

This unit consists of deep, nearly level, somewhat poorly drained soils of the Tetonka series. The surface and subsurface layers are silt loam and the subsoil is clay.

These soils are difficult to work because of wetness. Runoff collects in the depressions and ponds in them. Permeability is slow. Available water capacity is moder-

ate to high. Content of organic matter is moderate, and fertility is medium. The main concern of management is the control of excess water. Other concerns are the improvement of tilth and the maintenance of fertility and organic-matter content.

Where these soils are adequately drained, they are suited to all crops commonly grown. Alfalfa and tame grasses are the main crops. When wetness delays seeding of small grains or corn, early-maturing forage sorghum and silage corn are suitable replacement crops. Where artificial drainage is not produced, Tetonka soils are best suited to grazing and hay.

Returning crop residue to the soil and adding animal manure help to improve tilth and to maintain fertility and content of organic matter. Measures that reduce runoff from adjacent soils help to control wetness. Where suitable outlets are available, surface drains can be used to help remove excess water.

CAPABILITY UNIT IIs-1

Beadle loam, 0 to 2 percent slopes, is the only soil in this unit. This deep, well-drained soil has a clay loam subsoil. Permeability is moderately slow in the subsoil.

This soil has high available water capacity but takes water in slowly and releases it slowly to plants. It is slow to dry and loses its tilth if cultivated when it is wet. During long dry periods crops show stress sooner in this soil than in more permeable soils. Improving tilth and maintaining organic-matter content and fertility are concerns of management. Control of soil blowing is needed in some areas.

Corn, oats, sorghums grown for grain and forage, alfalfa, and tame grasses are the main crops.

Use of crop residue, conservation rotations that include legumes and grasses, and the use of manure help to improve tilth and to maintain fertility and content of organic matter. Including deep-rooted legumes in the cropping system helps to offset the moderately slow permeability of the subsoil. Using these practices along with stubble mulching helps to control soil blowing.

CAPABILITY UNIT IIc-1

This unit consists of deep, moderately well drained, loamy soils of the Bon and Prosper series. These soils are on bottom lands, on uplands in swales, and on foot slopes. They receive additional moisture from runoff from adjacent soils.

These soils are high in fertility and content of organic matter. Available water capacity is moderate to high and permeability is moderate to moderately slow. Planting and tillage are delayed in wet years, but in most years additional moisture provided by runoff benefits crop growth. The main concern of management is the conservation of moisture. Maintaining content of organic matter and maintaining fertility are also management needs.

These soils are well suited to all crops commonly grown in the county.

Use of crop residue and conservation rotations helps to conserve moisture and to maintain fertility and content of organic matter.

CAPABILITY UNIT IIc-2

This unit consists of deep, well-drained, loamy Clarno, Hand, and Houdek soils on uplands and of moderately well drained and somewhat poorly drained Davison and Prosper soils that are mapped in complexes with the Hand and Houdek soils.

These soils are easy to work and have moderate to moderately slow permeability. Available water capacity is moderate to high, content of organic matter is moderate to high, and fertility is medium to high, except in the Davison soils where it is medium to low. Conservation of moisture is the main concern of management. Other concerns of management include maintaining content of organic matter and fertility, and controlling soil blowing.

These soils are well suited to all crops commonly grown in the county.

Use of crop residue and conservation rotations helps to conserve moisture and to maintain the content of organic matter and fertility. These practices, as well as stubble mulching, also help to control soil blowing.

CAPABILITY UNIT IIIe-1

Clarno-Ethan loams, 6 to 9 percent slopes, are the only soils in this unit. These deep, well-drained, loamy soils on uplands are slightly to moderately eroded in many of the cultivated areas.

These soils are easy to work and are moderately permeable in the subsoil and slowly permeable in the underlying material. Available water capacity is high, and runoff is medium. Clarno soils are moderate in content of organic matter and medium in fertility, but Ethan soils are moderately low in content of organic matter and medium to low in fertility. Controlling water erosion is the main management concern. Maintaining or improving content of organic matter and fertility are also important concerns of management.

These soils are suited to all crops commonly grown in the county. Row crops are less suitable than other crops because of the erosion hazard.

Use of crop residue and conservation rotations and application of manure will help to maintain or to improve the content of organic matter and fertility and to control erosion. Also needed to help control erosion are terraces, contour farming or contour stripcropping, and grassed waterways. Where irregularity of slopes makes the application of these practices difficult, the alternative is the use of close-sown crops and emphasis on stubble mulching.

CAPABILITY UNIT IIIe-2

The Enet soil in Enet-Delmont loams, 3 to 6 percent slopes, is the only soil in this unit. It is well drained. This soil has a surface layer and a subsoil of loam, and it is moderately deep over sand and gravel. Permeability is moderate in the surface layer and the subsoil, and it is rapid in the underlying material.

This soil is easy to work, and it is moderate in content of organic matter and medium in fertility. Available water capacity is low, and runoff is medium. Controlling water erosion is one of the main concerns of management, but conservation of moisture is equally important on these droughty soils. Maintaining content of organic matter and maintaining fertility are other concerns of management.

Small grains, sorghums, and tame grasses are better suited than such deep-rooted crops as corn and alfalfa.

Use of crop residue, conservation rotations that include green manure crops, and animal manure will help to conserve moisture and to maintain the content of organic matter and fertility. Using these practices, along with contour farming or contour stripcropping, helps to control erosion. In places where irregularity of slopes makes contouring difficult, the alternative is emphasis on the use of close-sown crops and stubble mulching.

CAPABILITY UNIT IIIe-3

This unit consists of deep, well-drained, nearly level soils of the Blendon series on uplands. These soils have surface and subsoil layers of sandy loam, but in eroded areas the surface layer is loamy sand.

These soils are easily worked, and they are moderate in content of organic matter and medium in fertility. They have moderately rapid permeability and moderate available water capacity. These soils blow easily, and control of wind erosion is the main concern of management. Maintaining the content of organic matter and maintaining fertility are other concerns of management.

These soils are well suited to corn, oats, grain and forage sorghums, alfalfa, and tame grasses.

Use of crop residue, conservation rotations, stubble mulching, green manure crops, and animal manure helps to control soil blowing. These practices help conserve moisture and to maintain fertility and content of organic matter. Field windbreaks also help reduce soil blowing.

CAPABILITY UNIT IIIw-1

Fedora sandy loam, 0 to 3 percent slopes, is the only soil in this unit. This deep, somewhat poorly drained soil is high in content of lime and has a fluctuating water table. Sand and gravel are below a depth of 40 inches.

Content of organic matter is moderate, and fertility is low. Available water capacity is low to moderate, but spring planting and tillage operations are delayed by wetness. Concerns of management include improving drainage and fertility and maintaining the content of organic matter. In dry years controlling soil blowing is a management need.

Corn, oats, sorghums, alfalfa, and tame grasses are the main crops. Deep-rooted crops such as corn and alfalfa are better suited than shallow-rooted crops. Use of early-maturing crop varieties is recommended when wetness delays spring planting.

Use of crop residue, conservation rotations, and manure helps to maintain the content of organic matter and to improve fertility. Phosphate fertilizer will benefit crop growth. Use of wind stripcropping, stubble mulching, and field windbreaks helps to control soil blowing. Digging shallow open drains helps to regulate the level of the water table.

CAPABILITY UNIT IIIs-1

This unit consists of deep, moderately well drained, nearly level soils of the Stickney series on uplands. The surface and subsurface layers are loam, and the claypan subsoil is clay loam.

These soils are moderate in content of organic matter and medium in fertility. Available water capacity is high, but permeability is slow in the claypan subsoil, which restricts the movement of air and water and the penetration of plant roots. The claypan subsoil releases moisture slowly, and in dry years these soils are droughty. Runoff is slow and the soils are slow to dry. Tilth is easily destroyed and in dry years these soils are subject to blowing. Improving tilth, maintaining the content of organic matter and fertility, and controlling soil blowing are concerns of management.

Early-maturing crops, such as small grains, and drought-resistant crops, such as sorghums, are better suited than corn.

Use of crop residue, conservation rotations, and animal manure helps to improve tilth and to maintain the content of organic matter and fertility and to control soil blowing. Deep-rooted legumes in the rotation help to improve water intake. Stubble mulching following small grain harvest also helps to control soil blowing.

CAPABILITY UNIT IIIs-2

This unit consists of well-drained, nearly level Enet soils on terraces and uplands and of a moderately well drained or somewhat poorly drained Storla soil mapped in a complex with Enet soils. The soils are loamy and are underlain by sand and gravel at a depth between 20 to 36 inches.

Enet soils are moderate in content of organic matter and medium in fertility. Storla soils are similar to Enet soils, except that they are wetter and lower in organic-matter content. Permeability is moderate in the surface layer and in the subsoil and rapid in the underlying sand and gravel. Available water capacity is low and the soil is droughty. Conserving moisture, maintaining content of organic matter and fertility, and controlling soil blowing are concerns of management.

Corn, oats, grain sorghums, alfalfa, and tame grasses are the main crops. Early-maturing crops, such as small grains, and drought-resistant crops, such as grain sorghums, are better suited than corn.

Use of crop residue and stubble mulching helps to conserve moisture and to control soil blowing. Conservation rotations, green manure crops, and animal manure also help to conserve moisture and to maintain the content of organic matter and fertility.

CAPABILITY UNIT IIIs-3

This unit consists of moderately deep, moderately well drained to somewhat poorly drained, calcareous soils of the Firesteel and Storla series on terraces and uplands. Firesteel soils have surface and subsoil layers of silt loam and are underlain by bedded siltstone. Storla soils are of loam texture and are underlain by sand and gravel at a moderate depth.

These soils are moderate to moderately low in content of organic matter and are low in fertility. Availability of plant nutrients is affected by the high content of lime. Available water capacity is low to moderate, and these soils are somewhat droughty in dry years. Planting and tillage operations are delayed in some years by the rise of the water table. Concerns of management include improvement of fertility and content of organic matter and control of soil blowing.

Corn, oats, sorghums, alfalfa, and tame grasses are the main crops.

Use of crop residue, conservation rotations, animal manure, and commercial fertilizer helps to improve fertility, content of organic matter, and tilth. These practices and stubble mulching help to control soil blowing.

CAPABILITY UNIT IVe-1

This unit consists of shallow, somewhat excessively drained, gently undulating, loamy soils of the Delmont series on terraces and uplands. Gravel is at a depth of less than 20 inches.

These soils are easily worked. They are moderate in content of organic matter and low to medium in fertility. Available water capacity is low, and these soils are droughty. Runoff is medium, and cultivated areas are subject to both water erosion and soil blowing. Controlling erosion is the main concern of management. Conservation of moisture and improvement of the content of organic matter and fertility are other concerns of management.

Corn, oats, grain sorghums, alfalfa, and tame grasses are the main crops. Shallow-rooted crops, such as small grains and tame grasses, and drought-resistant crops, such as grain sorghums, are better suited than corn and alfalfa.

Use of crop residue, conservation rotations, and contour farming or contour stripcropping helps to control erosion and to conserve moisture. Terraces are not suited because of the shallow depth to gravel. If slopes are too irregular for contouring, the alternative is the use of close-sown crops and tame grasses. Green manure crops and animal manure help to increase content of organic matter and fertility.

CAPABILITY UNIT IVe-2

Redstoe loam, 3 to 9 percent slopes, is the only soil in this unit. This moderately deep, well-drained, calcareous soil is on uplands and is underlain by siltstone.

This soil is moderate in content of organic matter and is easily worked. Availability of plant nutrients is affected by the high content of lime, and fertility is low. Available water capacity is low, and permeability is moderate. Runoff is medium, and this soil is subject to both water erosion and soil blowing. The main concerns of management are control of erosion, improvement of fertility, maintenance of the content of organic matter, and conservation of moisture.

Small grains, corn, sorghums, alfalfa, and tame grasses are the crops grown. Small grains and sorghums are better suited than corn and alfalfa.

Use of crop residue, conservation rotations, and contour farming or contour stripcropping helps to control erosion and to conserve moisture. Terraces also help to control erosion. In many areas slopes are too irregular for contouring and terraces. The alternative in such areas is the use of close-sown crops and stubble mulching. Green manure crops, animal manure, and phosphate fertilizers will help to improve fertility and to maintain content of organic matter.

CAPABILITY UNIT IVw-1

Salmo silt loam is the only soil in this unit. This deep, poorly drained, level, calcareous soil is on bottom lands and is high in salts. It is subject to flooding and has a water table that rises within 2 feet of the surface in spring.

This soil is high in content of organic matter, but fertility is affected by the excessive amount of salts in the surface layer. Runoff is very slow and this soil is slow to dry. Wetness makes this soil difficult to work, and spring planting and tillage are delayed in most years. Controlling excess water is the main concern of management. Improving tilth and fertility are other concerns of management.

Many areas are used for grazing and hay. Salt-tolerant crops that mature early are best suited. Among the tame grasses, tall wheatgrass and tall fescue are better suited than smooth brome grass.

Shallow open drains help to regulate the water table and to improve drainage. Green manure crops and animal manure help to improve tilth and fertility.

CAPABILITY UNIT IVs-1

The Dudley soil in the Stickney-Dudley complex, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, moderately well drained to somewhat poorly drained soil on uplands. The surface layer is silt loam, and the claypan subsoil is clay loam. The lower part of the subsoil below a depth of 20 inches has a high content of salts.

This soil is difficult to work, and it loses tilth easily. Content of organic matter is moderate and fertility is medium. Available water capacity is moderate to high, but the claypan subsoil releases moisture slowly to plants, and the soil is droughty during dry periods. Permeability is slow to very slow, and runoff is slow. Improving tilth, maintaining content of organic matter and fertility, and controlling soil blowing are concerns of management.

Small grains, sorghums, alfalfa, and tame grasses are suitable crops. Only one cutting of alfalfa is harvested in dry years.

Use of crop residue, conservation rotations, green manure crops, and animal manure helps to improve tilth and to maintain fertility and content of organic matter. Stubble mulching helps to control soil blowing and to conserve moisture.

CAPABILITY UNIT IVs-2

The Delmont soil in Enet-Delmont loams, 0 to 3 percent slopes, is the only soil in this unit. It is a shallow, somewhat excessively drained, nearly level, loamy soil on terraces and uplands. Gravel is at a depth of less than 20 inches.

This soil is easily worked. It is moderate in content of organic matter and low to medium in fertility. Available water capacity is low, and this soil is droughty. Conservation of moisture is the main concern of management. Maintaining content of organic matter, improving fertility, and controlling soil blowing are other concerns of management.

Corn, oats, grain sorghums, alfalfa, and tame grasses are the main crops. Early-sown small grains and sorghums are more resistant to drought than corn and alfalfa.

Use of crop residue, conservation rotations, green manure crops, and animal manure helps to conserve moisture, maintain content of organic matter, and improve fertility. Stubble mulching helps to control soil blowing as well as to conserve moisture.

CAPABILITY UNIT IVs-3

Redstoe loam, 0 to 3 percent slopes, is the only soil in this unit. This moderately deep, well-drained, calcareous soil is on uplands and is underlain by siltstone.

This soil is easily worked and is moderate in content of organic matter. The high content of lime affects fertility, and the soil blows easily if not adequately protected. Available water capacity is low, and the soil is droughty. Improving fertility, maintaining content of organic matter and tilth, conserving moisture, and controlling soil blowing are management needs.

Small grains, corn, sorghums, alfalfa, and tame grasses are the crops grown. Small grains and sorghums are better suited than corn and alfalfa.

Use of crop residue, conservation rotations, green manure crops, animal manure, and phosphate fertilizer helps to improve fertility and to maintain content of organic matter and tilth. Stubble mulching helps to control soil blowing and to conserve moisture.

CAPABILITY UNIT Vw-1

Clamo silty clay loam, frequently flooded, is the only soil in this unit. This deep, poorly drained, level soil is on the lower level of bottom lands.

This soil is high in content of organic matter and in fertility. Available water capacity is high, and permeability is slow. Runoff is slow, and water ponds in some of the old channels. The areas are flooded in most years. Controlling excess water is the main concern of management.

Because of frequent flooding, this soil is unsuitable for cultivation, but it can be used for grazing and hay and as wildlife habitat. These uses will help to minimize damage from flooding.

CAPABILITY UNIT VIe-1

This unit consists of deep and moderately deep, undulating to hilly, well-drained to excessively drained, loamy soils of the Betts, Ethan, and Redstoe series on uplands. The Betts soils and eroded areas of the Ethan soils have calcareous surface layers.

These soils are low to moderate in content of organic matter and are low to medium in fertility. Permeability is moderate in the subsoil and moderately slow in the underlying material of the Betts and Ethan soils. Permeability is moderate in the subsoil of Redstoe soils, but the bedded siltstone limits the movement of water. Available water capacity is high in the Betts and Ethan soils and low in the Redstoe soils. Runoff is medium to rapid. Controlling water erosion is the main concern of management.

These soils are better suited to grazing and hay than to cultivated crops. Recommended grass species can be used to seed eroded areas still in cultivation. Proper use of pastures helps to control erosion. Pasture furrows also help to reduce runoff and to control erosion.

CAPABILITY UNIT VIw-1

Only Alluvial land is in this capability unit. It consists of mixed soils and recent alluvium. The areas are narrow and are cut into small tracts by stream channels. They are subject to frequent flooding and in many places there is a high water table.

Fertility ranges from low to high, and permeability ranges from slow to rapid. Controlling excess water, streambank erosion, and deposition of sediment and debris is the main concern of management.

Most areas are well suited to native vegetation, and they are used for grazing and hay and as wildlife habitat. Some of the larger tracts are well suited to tame grasses and alfalfa. Keeping a cover of grass or alfalfa on the surface helps to minimize damage from flooding. Proper management of pastures and practices to protect the watersheds upstream help to lessen the hazard of streambank erosion.

CAPABILITY UNIT VIIe-1

This unit consists of shallow to deep, well to excessively drained, hilly to steep soils of the Betts, Ethan, and Gavins series. The Betts and Ethan soils are loams formed in glacial till, and the Gavins soils are silt loams that are shallow to siltstone. The Betts and Gavins soils are calcareous.

These soils are low in content of organic matter and in fertility. Permeability is moderate to moderately slow, and runoff is rapid. Controlling water erosion is the main concern of management.

These soils are too steep for cultivation, but they are suitable for grazing and for other less intensive uses. Erosion is best controlled by proper use of pastures.

Predicted yields

Table 2 lists the predicted average yields per acre of corn, oats, grain sorghums, and alfalfa grown in the county on soils judged suitable for crops. Also shown are animal-unit-months of grazing that can be expected where these soils are used for tame pasture. The predictions are for dryfarmed soils under two levels of management.

The predictions shown in columns A are those that can be expected under current management practice in this county. Under such management, (1) a cropping system that improves and protects the soils and that conserves moisture is not used, or the cropping system is poorly planned; (2) water erosion and soil blowing cause soil losses in some years; (3) animal manure, green manure crops, and commercial fertilizer are not extensively used; and (4) tame pastures generally are overstocked and grazed too closely.

Predicted yields shown in columns B are those that can be expected under improved management, which includes (1) using a cropping system that helps to maintain content of organic matter, tilth, and fertility; (2) using a combination of practices that help to control erosion and to conserve moisture; (3) using animal manure and green manure crops to improve content of organic matter and tilth; (4) adding commercial fertilizer in amounts indicated by soil tests and field trials; and (5) properly managing tame pastures.

These predictions are based on information supplied by representative farmers throughout the county and by agriculturists of state and federal agencies serving Davison County. They also are based on current knowledge of agricultural technology. The predictions were compared with yield data of the South Dakota Crop and Livestock Reporting Service (*5*).

TABLE 2.—*Predicted average acre yields of principal crops under two levels of management on soils suited to dryland farming*

[Yields in columns A are those to be expected under prevailing management, those in columns B, under improved management]

Soil	Corn		Oats		Grain sorghum		Alfalfa		Tame pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*A.U.M.*[1]	*A.U.M.*[1]
Beadle loam, 0 to 2 percent slopes	36	52	36	56	35	57	1.6	2.5	1.9	2.9
Blendon sandy loam, 0 to 3 percent slopes	28	47	26	43	28	47	1.2	1.7	1.7	2.5
Blendon-Firesteel complex, 0 to 3 percent slopes	26	42	24	40	26	43	1.1	1.7	1.6	2.3
Bon loam, 0 to 2 percent slopes	39	58	44	60	39	62	1.9	3.2	2.3	3.4
Clamo silty clay loam	30	42	32	47	31	44	1.3	2.3	1.8	3.2
Clarno-Ethan loams, 3 to 6 percent slopes	32	46	32	52	32	48	1.5	2.3	1.6	2.6
Clarno-Ethan loams, 6 to 9 percent slopes	30	44	30	50	29	45	1.3	2.1	1.3	2.5
Clarno-Houdek loams, 0 to 3 percent slopes	38	55	36	60	37	58	1.7	2.7	2.0	3.1
Clarno-Houdek loams, 3 to 6 percent slopes	34	48	35	58	34	52	1.6	2.6	1.8	3.0
Davison-Hand loams, 0 to 2 percent slopes	27	45	36	57	29	49	1.4	2.3	1.7	2.7
Delmont loam, 3 to 6 percent slopes	8	16	13	23	8	18	.4	.9	.6	.9
Enet loam, 0 to 3 percent slopes	28	38	27	41	28	39	1.4	2.0	1.8	2.4
Enet-Delmont loams, 0 to 3 percent slopes:										
Enet soil	28	38	27	41	28	39	1.4	2.0	1.8	2.4
Delmont soil	10	20	15	25	10	22	.6	.9	.8	1.0
Enet-Delmont loams, 3 to 6 percent slopes:										
Enet soil	26	36	26	39	27	37	1.3	1.9	1.7	2.3
Delmont soil	8	16	13	23	8	18	.4	.9	.6	.9
Enet-Storla loams, 0 to 2 percent slopes	28	39	26	41	28	42	1.3	2.1	1.6	2.5
Fedora sandy loam, 0 to 3 percent slopes	24	38	24	39	25	40	1.4	2.4	1.5	2.6
Firesteel silt loam, 0 to 2 percent slopes	22	34	20	35	23	36	1.0	1.6	1.1	1.9
Hand loam, 3 to 6 percent slopes	25	44	32	53	29	43	1.5	2.3	1.7	2.7
Hand-Davison loams, 0 to 3 percent slopes	29	48	39	58	30	52	1.6	2.3	1.7	2.8
Houdek-Prosper loams, 0 to 2 percent slopes	40	59	42	66	40	63	1.9	2.9	2.1	3.3
Houdek, Prosper and Stickney loams, 0 to 1 percent slopes:										
Houdek soil	39	58	40	65	39	61	1.8	2.8	2.0	3.2
Prosper soil	42	60	46	67	42	64	2.0	3.0	2.2	3.5
Stickney soil	29	42	32	48	30	45	1.4	2.3	1.8	2.9
Houdek-Stickney loams, 0 to 2 percent slopes:										
Houdek soil	39	58	40	65	39	61	1.8	2.8	2.0	3.2
Stickney soil	29	42	32	48	30	45	1.4	2.3	1.8	2.9
Lamo silt loam	32	52	42	55	33	55	1.9	3.2	2.2	3.5
Lamo and Prosper soils, 0 to 3 percent slopes:										
Lamo soil	32	52	42	55	33	55	1.9	3.2	2.2	3.5
Prosper soil	40	58	44	65	40	58	2.0	3.0	2.2	3.5
Prosper silt loam, 0 to 3 percent slopes	40	58	44	65	40	58	2.0	3.0	2.2	3.5
Prosper silt loam, 3 to 6 percent slopes	36	49	38	61	36	55	1.9	2.6	1.9	3.1
Redstoe loam, 0 to 3 percent slopes	13	17	26	46	15	21	1.0	1.8	1.3	2.6
Redstoe loam, 3 to 9 percent slopes	12	17	23	40	13	19	.8	1.5	1.1	1.9
Salmo silt loam	24	34	29	40	22	32	1.8	2.6	2.2	3.5
Stickney-Dudley complex, 0 to 2 percent slopes:										
Stickney soil	29	42	32	48	30	45	1.4	2.3	1.8	2.9
Dudley soil	16	25	16	30	16	30	.7	1.0	1.1	1.6
Storla loam, 0 to 2 percent slopes	24	39	25	41	24	42	1.2	2.1	1.4	2.4
Storla complex, 0 to 2 percent slopes	20	36	20	38	19	38	1.4	2.6	1.6	2.7
Tetonka silt loam, 0 to 2 percent slopes	30	46	27	44	30	48	1.8	2.3	2.1	3.0
Tetonka-Stickney complex, 0 to 3 percent slopes	30	44	30	46	30	47	1.7	2.3	2.0	3.0

[1] Animal-unit month refers to the amount of forage required to maintain 1 animal unit (1 cow, horse, or mule; or 5 sheep or 5 goats) per acre for a period of 30 days without damage to pasture.

The predictions are based on planted acres rather than harvested acres. They are averages for a period long enough to include years of below average, average, and above average precipitation.

Managing the Soils for Pasture [3]

About 23 percent of the acreage of Davison County is in pasture. Production of livestock and livestock crops is an important enterprise on most farms. Some pastures are in native grasses, but many are in tame grasses. The aim of pasture management is to grow forage needed by the grazing animals and at the same time to maintain an adequate cover of grass that will help to control soil and water losses.

Pasture management involves adjusting the number of grazing animals in accordance with the amount of forage grown on different kinds of soil. The yield predictions in table 2 show the animal-unit months of grazing that can be expected under two levels of management. Grazing begins when the grass has reached the proper height. The livestock is removed when the grass is grazed to a height that will maintain the vigor of the grasses without damaging the pasture.

Among other practices to consider in pasture management are the use of commercial fertilizer as needed; rotation grazing; brush and weed control; development of livestock water facilities; clipping to encourage uniform grazing; and reseeding pasture to the more productive species for improving yields.

All soils in Davison County are suited to use as tame pasture except the steep soils of the Betts, Ethan, and Gavins series. Soils that are similar in suitability for pasture planting, in potential for forage production, and in management needs are grouped into pasture suitability groups. The names of the series represented are mentioned in the description of each group, but this does not mean that all the soils in a given series are in the group. The pasture suitability group of each individual soil is given in the "Guide to Mapping Units" at the back of this survey.

PASTURE GROUP A

This suitability group consists of deep, moderately well drained and poorly drained soils of the Clamo, Fedora, Lamo, Storla, and Tetonka series. The surface layer of these soils ranges from sandy loam to silty clay loam in texture and is calcareous except for Clamo and Tetonka soils.

All of these soils have a water table near enough to the surface to benefit pasture plants. Lamo, Clamo, and Tetonka soils also receive additional moisture from flooding in some years, but drainage is established on these soils. Because of these additional sources of moisture, the potential yield of forage is 2 to 3 times greater on Lamo and Clamo soils than on the other soils in this group on uplands. In addition, new growth is available throughout the grazing season.

Suitable grasses and legumes are smooth bromegrass, intermediate wheatgrass, Kentucky bluegrass, reed canarygrass, Garrison creeping foxtail, alfalfa, and sweetclover. Smooth bromegrass grows well on soils ranging from sandy loam to silt loam in texture. Intermediate wheatgrass is best suited to soils that have a texture of loam, silt loam, silty clay loam, and clay loam. Alfalfa and sweetclover can be seeded with smooth bromegrass and intermediate wheatgrass.

PASTURE GROUP B

In this group are somewhat poorly drained and poorly drained soils of the Clamo, Lamo, and Tetonka series and Alluvial land. Tetonka soils are frequently flooded by runoff from adjacent soils. Clamo and Lamo soils and Alluvial land are flooded by stream overflow, and they contain old channels where water is trapped. The duration of water impoundment is short, but wetness restricts the kinds of grass that can be grown.

Suitable grasses are reed canarygrass and Garrison creeping foxtail. Seedbed preparation is feasible only in fall. Where drainage is provided on the Clamo, Lamo, and Tetonka soils, they are in pasture group A.

PASTURE GROUP C

The Dudley soil in Stickney-Dudley complex, 0 to 2 percent slopes, is the only soil in this pasture group. This soil is deep and is moderately well drained or somewhat poorly drained. It has a surface layer and a subsurface layer of silt loam or loam and a dense, compact, claypan subsoil ranging from clay loam to clay in texture. The claypan subsoil is high in content of sodium.

Penetration of plant roots is restricted by the dense, compact subsoil. Available water capacity is moderate to high, but permeability is slow to very slow, and the claypan subsoil releases moisture very slowly to plants.

Suitable grasses and legumes are crested wheatgrass, Russian wildrye, intermediate wheatgrass, western wheatgrass, pubescent wheatgrass, and sweetclover. Sweetclover can be seeded with any of these grasses. Pubescent wheatgrass is more drought resistant than intermediate wheatgrass. Russian wildrye is best established on summer fallow. Crested wheatgrass is suitable for spring and fall grazing.

PASTURE GROUP D

In this group are shallow and moderately deep, loamy soils of the Delmont and Enet series. Sand and gravel are at a depth of less than 20 inches in the Delmont soils and at a depth of 20 to 36 inches in the Enet soils. Available water capacity is low, and these soils are droughty.

Grasses and legumes tolerant to dry conditions are intermediate wheatgrass, pubescent wheatgrass, crested wheatgrass, Russian wildrye, and sweet clover. Sweetclover can be sown with any of these grasses. Establishment of Russian wildrye is best achieved following summer fallow.

PASTURE GROUP E

This group consists of deep, moderately well drained and well drained soils of the Beadle and Stickney series. These soils have a surface layer of loam and a subsoil of clay loam.

Permeability is slow in the claypan subsoil of the Stickney soils and moderate in the friable layers above the claypan. Permeability is moderately slow in the Beadle soils. Available water capacity is high, but moisture from the subsoil is released slowly to plants. Plant roots penetrate the clayey subsoil with difficulty and are noticeably compressed in the Stickney soil.

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[3] By WALTER PARMETER, agronomist, Soil Conservation Service.

Suitable grasses and legumes for these soils are intermediate wheatgrass. Russian wildrye, pubescent wheatgrass, western wheatgrass, crested wheatgrass, alfalfa, and sweet clover. Pubescent wheatgrass and crested wheatgrass are more drought resistant than intermediate wheatgrass. Legumes can be planted with any of the grasses. Russian wildrye is best established following summer fallow.

PASTURE GROUP F

In this group are deep and moderately deep, well drained, moderately well drained, and somewhat poorly drained loamy and silty soils of the Clarno, Ethan, Firesteel, Hand, and Houdek series.

These soils have moderate to moderately slow permeability. All except Firesteel soils have moderate to high available water capacity. Firesteel soils have moderate to low available water capacity.

These soils are well suited to most tame grasses and legumes. Suitable species for planting are smooth bromegrass, intermediate wheatgrass, crested wheatgrass, Russian wildrye, alfalfa, and sweetclover. Alfalfa and sweetclover can be sown with any of these grasses. Crested wheatgrass and Russian wildrye are not suitable for sowing where slope is more than 5 percent. Russian wildrye is best established following summer fallow.

PASTURE GROUP G

In this group are deep and moderately deep, well-drained to excessively drained, calcareous, loamy Betts and Redstoe soils and also an eroded Ethan soil.

Permeability is moderate to moderately slow, but runoff is medium to rapid, which reduces the amount of moisture for plant growth. These soils are low in fertility and low to moderate in content of organic matter.

Suitable tame grasses are intermediate wheatgrass, pubescent wheatgrass, and crested wheatgrass. Pubescent wheatgrass and crested wheatgrass are more drought resistant than intermediate wheatgrass. Crested wheatgrass is not suitable for sowing if soil slope is more than 5 percent, because of the erosion hazard. Sweet clover is a better suited legume than alfalfa.

PASTURE GROUP H

In this group are deep, well-drained, sandy loam soils of the Blendon series. These soils take in water easily and release it readily to plants. They have moderate available water capacity.

Suitable grasses and legumes are smooth bromegrass, crested wheatgrass, switchgrass, alfalfa, and sweetclover. Late in spring is the best time for seeding switchgrass.

PASTURE GROUP J

Salmo silt loam is the only soil in this group. This soil has a high water table, and the surface layer has a high content of salt.

Suitable grasses and legumes are those that are salt tolerant. They include tall wheatgrass, western wheatgrass, tall fescue, slender wheatgrass, and sweet clover.

PASTURE GROUP K

In this group are deep, moderately well drained, loamy soils of the Bon, Davison, and Prosper series. Fertility and the content of organic matter are high in the Bon and Prosper soils. Fertility is medium to low in Davison soils, and the content of organic matter is moderate. For all these soils, permeability is moderate, available water capacity is moderate to high, and runoff is slow to medium. Bon and Prosper soils receive runoff from adjacent soils on uplands. Bon soils are subject to occasional stream flooding. Davison soils have a seasonal high water table in spring. The additional moisture is sufficient to produce 1½ to 2 times the forage produced on well-drained soils.

These soils are well suited to most tame grasses and legumes. The best suited species are alfalfa, big bluestem, birdsfoot trefoil, Garrison creeping foxtail, indiangrass, intermediate wheatgrass, Kentucky bluegrass, orchardgrass, reed canarygrass, smooth bromegrass, switchgrass, and timothy.

Use of the Soils for Windbreaks [4]

Less than 1 percent of the acreage of Davison County is in native woodland. Most of these areas are along the principal streams. Cottonwood, willow, American elm, green ash, and hackberry are the main species of trees. Chokecherry, wild plum, and other minor shrubs are in the understory of the native woodland areas. These native stands have little commercial value, but they provide wildlife habitat and contribute to the beautification of the countryside.

Since the earliest days of settlement, Davison County farmers have planted windbreaks for the protection of farmsteads and feedlots. Farmstead windbreaks (fig. 13) are established around buildings to protect the farm family, livestock, buildings, and yards from damaging winds, snow, and soil blowing. They also furnish protection to wildlife, fruit trees, and gardens.

Many wide field windbreaks were planted under the Prairie States Forestry Project from 1935 to 1942. Most of these plantings are still vigorous in growth and are effective in reducing soil blowing, reducing crop damage from hot summer winds, and holding drifting snow. They also provide food and cover for wildlife and add to the attractiveness of the landscape. In recent years the trend is to plant narrow field windbreaks consisting of one to three rows of trees and shrubs that provide adequate protection to fields when used in combination with other conservation practices.

Some soils are well suited to many trees and shrubs; some are well suited to only a few; and some are not suited to any trees or shrubs. The soils in Davison County that are suitable for tree and shrub planting are placed in nine windbreak suitability groups.

Table 3 can be used as a guide for selecting trees and shrubs that are best suited to each group. Condition or suitability rating is based on the estimated vigor and growth of trees and shrubs. Heights were measured. All measurements and observations were made on trees and shrubs growing in properly cared for windbreaks that have been established at least 20 years. The criteria for conditions or suitability ratings of trees and shrubs follow.

The rating is *good* where—

Leaves or needles are normal in color and growth.

[4] By E. J. DANIEL, State soil conservationist, and JAMES C. HUNT, district conservationist, Soil Conservation Service.

The crowns contain only a small amount of dead twigs and branches.
Damages from insects and diseases and from the effects of climate are slight.
Evidence of suppression or stagnation is slight.

The rating is *fair* where—

Leaves or needles are obviously abnormal in color and growth.
The crowns contain substantial amounts of dead twigs and branches.
Damages from insects and diseases and from the effects of climate are obvious.
Definite suppression or stagnation exists.
Current-year's growth is obviously less than normal.

The rating is *poor* where—

Leaves or needles are very abnormal in color and growth.
The crowns contain very large amounts of dead twigs and branches.
Damages from insects and diseases and from the effects of climate are extensive.
Plants show severe stagnation, suppression, or decadence.
Current-year's growth is essentially negligible.

Windbreak suitability groups in Davison County are described in the following paragraphs. The windbreak groups are not numbered consecutively, because not all the groups in the statewide system are used. The names of the soil series represented are mentioned in each group, but this does not mean that all the soils of a given series are in the group. To find the windbreak suitability group of any given soil, refer to the "Guide to Mapping Units" at the back of this survey.

WINDBREAK SUITABILITY GROUP 1

In this group are deep, moderately well drained, loamy soils of the Bon, Davison, and Prosper series. Their surface and subsoil layers are loam, except for Prosper soils, which have a clay loam subsoil. Content of organic matter is moderate to high, and fertility is high in all these soils except the Davison soils, which are medium to low in fertility. These soils are on upland swales or on foot slopes that receive additional moisture in the form of runoff from adjacent soils. In addition, Davison soils

Figure 13.—Farmstead windbreak and connecting field windbreaks on Clarno-Houdek loams, 0 to 3 percent slopes.

have a fluctuating water table that is high enough to benefit tree roots.

The additional moisture in these soils is beneficial for tree growth. Consequently, these soils are the most favorable soils in the county for trees. They are good for windbreak plantings for the protection of fields, farmsteads, and feedlots. They are also well suited to plantings for recreation and for wildlife habitat.

WINDBREAK SUITABILITY GROUP 2

In this group are deep and moderately deep, moderately well drained to somewhat poorly drained and poorly drained, level and nearly level soils of the Clamo, Fedora, Firesteel, Lamo, and Storla series. The mapping unit Alluvial land is also in this group. These soils vary widely in texture, and they are neutral to moderately alkaline in reaction. Some of these soils are calcareous throughout their profile, and some are not. All of these soils have a high water table, and Clamo and Lamo soils are subject to flooding. Runoff is slow to very slow.

Soils of this group are suited to windbreak plantings for the protection of fields, farmsteads, and feedlots. They are also suited to plantings for recreation and for wildlife habitat. Most adapted trees and shrubs grow well because of the abundant supply of moisture, but some species do not grow well because of shallowness to the water table. Providing drainage helps to regulate wetness and to improve growing conditions for trees.

WINDBREAK SUITABILITY GROUP 3

In this group are deep, well-drained, loamy soils of the Clarno, Ethan, Hand, and Houdek series. All these soils have a surface layer of loam, and except for Houdek soils, the subsoil is loam. Houdek soils have a clay loam subsoil. Reaction of the surface and subsoil layers ranges from neutral to moderately alkaline.

Content of organic matter is moderate and fertility is medium to high in all these soils except Ethan soils. Ethan soils are moderately low in content of organic matter, and they are medium to low in fertility. Permeability is moderate and available water capacity is moderate to high. Where slopes are greater than 2 percent, these soils are subject to water erosion.

Soils of this group are well suited to windbreak plantings for the protection of fields, farmsteads, and feedlots. They also are suited to plantings for recreation and wildlife habitat.

WINDBREAK SUITABILITY GROUP 4

In this group are deep, well drained and moderately well drained soils of the Beadle and Stickney series. These soils have a surface layer of loam and a subsoil of clay loam or clay. Reaction is slightly acid to mildly alkaline in the surface and subsoil layers and moderately to strongly alkaline in the underlying material

Available water capacity is high, but permeability is moderately slow or slow, and the clayey subsoil releases moisture slowly to tree roots. In dry years trees and shrubs are damaged by lack of moisture.

These soils are moderately well suited to windbreak plantings to protect fields, farmsteads, feedlots, and wildlife. They also are moderately well suited to recreational and beautification plantings. Height of tree growth is less on the soils in this group than on soils that have more favorable moisture characteristics.

WINDBREAK SUITABILITY GROUP 5

In this group are deep, well-drained, sandy loam soils of the Blendon series. Reaction is neutral. These soils take in water easily and release it readily to plant roots. Available water capacity is moderate. Permeability is moderately rapid, and runoff is slow. These soils are susceptible to wind erosion, and they are somewhat droughty.

Soils of this group are well suited to windbreak plantings to protect fields, farmsteads, and feedlots. They are also well suited to plantings for recreation and wildlife habitat. Generally, tree growth and vigor are very good; but tree plantings are damaged by lack of moisture during periods of drought.

WINDBREAK SUITABILITY GROUP 6

In this group are moderately deep, well-drained, loamy soils of the Enet series. These soils are underlain by sand and gravel at a depth ranging from 20 to 36 inches.

Content of organic matter and fertility are moderate. Permeability is moderate in the upper part of the profile and rapid in the underlying sand and gravel. Available water capacity is low, and these soils are droughty.

These soils are poorly suited to field windbreaks. They are also poorly suited to windbreaks for protecting farms and feedlots and to wildlife habitat, recreation, and beautification plantings. They can be used for these purposes if optimum growth is not a critical need or if additional moisture is provided.

WINDBREAK SUITABILITY GROUP 8

In this group are moderately deep, well-drained, calcareous, loamy soils of the Redstoe series. Redstoe soils are underlain by siltstone at a depth ranging from 22 to 40 inches.

These soils are high in content of lime and are low in fertility. Available water capacity is low. Much of the moisture needed for plant roots is lost because of medium to rapid runoff. These soils are susceptible to water erosion and soil blowing.

Soils of this group are poorly suited to field windbreaks. They are moderately well suited to farmstead and feedlot windbreaks and to recreation, beautification, and wildlife habitat plantings. Contour plantings help to control erosion and to conserve moisture.

WINDBREAK SUITABILITY GROUP 9

In this group are deep, moderately well drained to somewhat poorly drained soils of the Dudley series. These soils have silt loam surface and subsurface layers and claypan subsoils of clay loam.

Reaction in the upper part of the profile is slightly acid to neutral, but the lower part contains a moderate amount of sodium and is moderately to strongly alkaline. Available water capacity is moderate to high; but permeability is slow to very slow, and the claypan subsoil releases moisture slowly to the roots of trees and shrubs. The dense claypan slows the development of roots, and trees and shrubs do poorly during periods of drought.

TABLE 3.—*Condition and height of trees and shrubs at 20*

[Condition ratings are defined in the text. Heights

Woodland species	Group 1		Group 2		Group 3	
	Condition	Height	Condition	Height	Condition	Height
		Ft.		*Ft.*		*Ft.*
American elm	Good	24–28	Good	22–26	Good	20–22
Black Hills and Colorado blue spruces	Good	24–30	Good	20–24	Good	24–28
Boxelder	Fair	20–22	Fair	18–20	Fair	20–22
Buffaloberry	Good	8–10	Fair	6–8	Good	7–9
Caragana	Good	9–11	Good	7–9	Good	9–10
Chokecherry	Good	12–14	Fair	9–11	Good	9–12
Cotoneaster	Good	6–7	Fair	5–6	Good	5–6
Cottonwood	Fair-Good	35–40	Poor-Good	32–36	Poor	----------
Crabapple	Good	18–20	Good	16–18	Good	15–17
Eastern and Rocky Mountain redcedars	Good	15–18	Good	14–16	Good	13–15
Green ash	Good	23–27	Good	20–24	Good	20–24
Hackberry	Good	23–27	Good	22–26	Good	20–24
Harbin pear	Good	16–18	Good	14–16	Good	15–17
Honeylocust	Good	30–34	Good	30–34	Fair	26–30
Honeysuckle	Good	8–10	Good	6–8	Good	7–9
Lilac	Good	7–8	Good	5–6	Good	6–7
Nanking cherry	Good	5–7	Fair	4–5	Fair	5–6
Plum	Good	8–9	Good	5–6	Good	8–9
Ponderosa pine	Good	24–30	Good	20–22	Good	22–26
Russian-olive	Fair	18–20	Fair	14–16	Fair	15–18
Siberian, dropmore, and Chinkota elms	Good	32–36	Good	24–28	Good	30–32
White and golden willows	Good	32–35	Good	30–34	Poor	----------

[1] Data are not provided for soils in windbreak group 10, because these soils are not suited to field windbreaks. Soils in this group this may be suited to plantings for other purposes, if the plants are selected according to conditions that prevail at sites proposed for planting. A

These soils are poorly suited to field windbreaks, but they are suitable for other kinds of tree plantings where response and vigor are less critical. Selectivity of species is limited.

WINDBREAK SUITABILITY GROUP 10

In this group are soils of the Betts, Delmont, Ethan, Gavins, Redstoe, Salmo, and Tetonka series. Delmont soils are shallow to sand and gravel, and Gavins soils are shallow to siltstone. The Betts, Ethan, and Redstoe soils in this group are too steep for windbreak plantings. Salmo soils are frequently flooded, and they have a high water table. Their surface layer is high in salts. Water periodically ponds on Tetonka soils.

Soils of this group are too shallow, too steep, or too wet for windbreak plantings. Under special care, hand planting of adapted species for beautification and wildlife is feasible on most soils of this group. Except for Tetonka soils, provisions for additional moisture generally are necessary for the survival of plantings. If Tetonka soils are adequately drained, they are suitable for adapted plant species.

Use of the Soils for Wildlife [5]

Wildlife is a product of the land; and, like cropland and pastureland, it will respond to good management. The production of adapted wildlife usually is in balance with the necessary habitat that provides food and cover. The nature and adequacy of wildlife habitat is closely related to the suitability of the soil for growing native and introduced plants. The soil associations described in the section "General Soil Map" are grouped into four wildlife areas on the basis of their potential for various kinds of wildlife. These areas differ in potential, species, and environmental factors. The potential for wildlife development in the seven soil associations that comprise wildlife areas A, B, C, and D are summarized in table 4.

Wildlife area A consists of Enet and Delmont soils of association 1, of Blendon and Hand soils of association 2, and of Davison and other minor soils of both associations. These upland associations are mostly in cultivation and have a moderate potential for producing such farm game species as pheasant and cottontail rabbit.

The kinds of wildlife in the areas are influenced by the proximity of the area to the major streams in the county. Because of wildlife migrations up the drainageways from the main stream bottom lands there are minor populations of whitetail deer, mule deer, bobwhite quail, fox, raccoon, and opossum.

Among the measures that will improve habitat in this wildlife area are field windbreaks on the Hand and Davison soils and improved grassland management and wind stripcropping on the Blendon soils.

Abandoned gravel pits in areas of Delmont and Enet soils are suitable for use as sport fisheries. If these pits are excavated to a depth below the ground water level, they will fill with water and can be stocked with such fish species as bluegill and bass.

Wildlife area B consists of the Houdek and Stickney soils of association 3; of the Houdek, Prosper, and Tetonka

[5] By JOHN B. FARLEY, biologist, Soil Conservation Service.

years of age, by windbreak suitability groups of soils [1]

are not shown for species rated poor]

Group 4		Group 5		Group 6		Group 8		Group 9	
Condition	Height	Condition	Height	Condition	Height	Condition	Height	Condition	Height
	Ft.		*Ft.*		*Ft.*		*Ft.*		*Ft.*
Fair	24–28	Fair	20–24	Fair-Poor	10–12	Fair	14–16	Poor	
Poor		Poor		Poor		Poor		Poor	
Poor		Poor		Poor		Poor		Poor	
Good	7–9	Fair	6–8	Fair	5–6	Fair	4–5	Fair	3–4
Fair	7–8	Good	8–10	Fair	6–7	Fair	7–8	Fair	5–6
Good	10–12	Fair	9–11	Poor		Poor		Poor	
Good	6–7	Good	6–7	Fair	4–5	Fair	5–6	Poor	
Poor		Poor		Poor		Poor		Poor	
Fair	13–15	Good	17–19	Fair	12–14	Poor		Poor	
Good	15–17	Good	13–15	Fair	9–11	Fair	9–11	Fair	6–8
Fair	21–26	Good	22–36	Fair	12–14	Fair	14–16	Fair	10–12
Fair	22–24	Good	21–25	Fair	10–12	Fair	14–16	Poor	
Fair	13–15	Good	15–17	Fair	11–12	Fair	7–9	Fair	5–7
Fair	24–26	Fair	28–32	Fair-Poor	15–17	Fair	17–20	Poor	
Good	8–10	Good	6–7	Fair	5–7	Fair	6–8	Poor	
Fair	4–5	Good	6–7	Fair	4–5	Fair	5–6	Fair	3–4
Fair	4–5	Fair	4–5	Poor		Poor		Poor	
Good	8–9	Good	6–7	Poor		Fair	5–6	Poor	
Good	17–23	Good	20–24	Fair	13–15	Fair	14–16	Fair	10–12
Fair	16–22	Fair	14–18	Fair	9–12	Fair	14–16	Fair	8–10
Good	36–40	Good	30–34	Fair	16–20	Fair	18–22	Fair	12–14
Poor		Poor		Poor		Poor		Poor	

listing of the soils in windbreak group 10 is provided in the section "Use of the Soils for Windbreaks" and in the "Guide to Mapping Units" at the back of the survey.

soils of association 4; and of Beadle, Dudley, Prosper, and other minor soils of both associations. The nearly level soils in this wildlife area are intensively cultivated and have the potential of producing an abundance of food and cover for pheasant. Field and farmstead windbreaks in the area provide protection and cover for deer, as well as for pheasant. Most areas of Tetonka soils in this association are cultivated, but the few areas that are not cultivated provide nesting cover for waterfowl. Many of the farm ponds built in the area primarily for livestock water have been stocked with bass and bluegill, but their success has been limited.

Measures that benefit wildlife are the addition of more grasses and legumes in cropping systems used on Beadle, Dudley, and Stickney soils; the establishment of field windbreaks on Beadle, Houdek, and Prosper soils; more extensive use of grassed waterways; improved pasture management in areas adjacent to farm ponds; and the seeding of grass in the more poorly drained areas of Tetonka soils.

Wildlife area C consists of Clarno, Houdek, and Betts soils of association 5 and of Redstoe and Firesteel soils of association 6. These areas have more relief than other wildlife areas in the county. They contain nearly level to undulating uplands and rolling to steep valley side slopes interspersed with narrow drainageways and narrow bottom lands. Most of the nearly level to undulating soils are cultivated, but the rolling to steep soils are in native grasses and are used for grazing. Also included in this wildlife area are small, permanent water marshes, mostly in the southeastern parts of association 5, which provide habitat for waterfowl and muskrat. The rolling to steep soils provide good cover for deer that migrate from the adjacent stream valleys. Farm ponds in this wildlife area have a moderate potential for panfish fisheries (fig. 14).

Many of the soils in this wildlife area are subject to water erosion and to soil blowing. Erosion control practices that improve the habitat for pheasant and other wildlife in the area are contour stripcropping on gently undulating to undulating Clarno, Ethan, Houdek and Redstoe soils; grass seeding of point rows and of eroded areas of Betts and Ethan soils; establishing grassed waterways on Prosper soils; improving pasture management on such soils as Betts, Ethan, and Gavins; developing wildlife habitat in areas adjacent to farm ponds; and maintaining marsh and the more poorly drained areas of Tetonka soils as habitat for waterfowl and other wildlife.

Wildlife area D consists of the Clamo, Lamo, and Bon soils of association 7. This area, along the James River and its main tributaries, is distinguished from other wildlife areas in the county by the presence of strips and patches of native woodland. The mixed woodlands, native and tame pastures, haylands, and cultivated areas provide food, cover, and winter protection for deer, pheasant, partridge, bobwhite quail, tree squirrel, and mourning dove. Beaver, fox, mink, muskrat opossum, and raccoon are more numerous in this wildlife area than in the other wildlife areas of the county.

Lake Mitchell is used for fishing, boating, water sports, and picnicking. Rough fish, mainly carp and shad,

TABLE 4.—*Potential for wildlife development by soil associations and wildlife areas*

Soil association	Wildlife area	Upland game birds	Waterfowl	Fish ponds	Big game	Fur-bearing animals
1. Enet-Delmont	A	Moderate	Moderate	Fair	Fair	Poor.
2. Blendon-Hand	A	Moderate	Moderate	Fair	Fair	Poor.
3. Houdek-Stickney	B	Excellent	Fair	Poor	Poor	Poor.
4. Houdek-Prosper-Tetonka	B	Excellent	Fair	Fair	Poor	Poor.
5. Clarno-Houdek-Betts	C	Excellent	Excellent	Fair	Moderate	Fair.
6. Redstoe-Firesteel	C	Fair	Fair	Poor	Moderate	Poor.
7. Clamo-Lamo-Bon	D	Excellent	Excellent	Excellent	Moderate	Excellent.

dominate the population . Game fish include channel catfish, bullhead, crappie, bass, bluegill, walleye pike, and northern pike. Lake Mitchell also provides a rest stop for migratory waterfowl.

The James River is the only natural water fishery in the county. Fishing for black bullhead, the main species in this stream, provides a means of recreation.

Improved management of pasture, hayland, and native woodland will do much to enhance wildlife habitat in this soil association.

Engineering Uses of the Soils[6]

This section is useful to those who need information about soils used as structural material or as foundations upon which structures are built. Some of those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

[6] By JOHN P. TORGERSON, agricultural engineer, Soil Conservation Service.

Figure 14.—**Farm pond in soil association 5 developed as a fishery.**

Among the properties of soils that are highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are slope and depth to the water table and to bedrock. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, 7, and 8, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 6. It also can be used to make other useful maps.

The engineering interpretations provided in this survey do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Estimates generally are made to a

depth of about 5 feet and these interpretations do not apply to greater depths. Also, engineers should not apply specific values to the estimates for bearing capacity and traffic-supporting capacity given in this survey. Investigation of each site is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

Some of the terms used in this soil survey have special meanings to soil scientists that are not known to all engineers. Many of the terms commonly used in soil science are defined in the Glossary at the back of this survey.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*10*) used by the SCS engineers, Department of Defense, and others, and the AASHO system (*1*) adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in tables 7 and 8; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

Estimated properties of the soils

Table 5 lists the soil series and the mapping units in Davison County and provides estimates of soil properties important to engineering. These estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas and from detailed experience gained in working with the individual kind of soil in the survey area. A more complete description of each soil is found in the section "Descriptions of the Soils."

The seasonal high water table in soils is shown by the number of feet below the surface it is expected to be encountered. During years of abundant moisture, the water table may rise to high levels; but during years of drought, the water table can be expected to remain low.

USDA texture is determined by the relative proportions of sand, silt, and clay in the soil material that is less than 2.0 millimeters in diameter. Terms used in the USDA textural classification are defined in the glossary.

Particle size distribution is shown in the percentages passing the number 4, 10, 40, and 200 sieves. The percentages reflect the ranges that can be expected for that soil in Davison County.

Permeability, as used in table 5, relates only to the movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from the use of the soils are not considered.

Available water capacity is the capacity of soils to store water available for use by most plants. It is the difference between the amount of water at field capacity and the amount of water held in the soil when plants are permanently wilted. It is expressed in inches of water per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and relative terms are defined in the Glossary.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to maintenance of structures built in, on, or with such material.

Corrosivity, as used in table 5, indicates potential danger to uncoated steel or concrete through chemical action that dissolves or weakens structural material. Structural materials may corrode when buried in a soil, and a given material corrodes more rapidly in some soils than in others. Extensive installations that intersect soil boundaries or soil horizons are more likely to be damaged by corrosion than are installations entirely in one kind of soil or soil horizon.

Depth to bedrock is not shown, because most soils in Davison County are deep to bedrock. In the Firesteel, Gavens, and Redstoe soils, depth to soft siltstone is less than 40 inches.

The Salmo soils have moderate salinity in the surface layer. Several soils have layers of salt in the subsoil or in underlying material or in both. Salt restricts the growth of plants and increases the corrosivity to steel and concrete.

Engineering interpretations of soil properties

Table 6 rates the soils in Davison County as to the degree of limitation for septic tank absorption fields, sewage lagoons, dwellings with basements, sanitary landfills, and local roads and streets. It shows the suitability of the soils as a source for road fill material, for sand and gravel, and for topsoil. Also given in table 6 are features that affect suitability of soils for pond reservoirs, embankments, dikes and levees, irrigation, terraces and diversions, and highway location.

TABLE 5.—*Estimates of soil properties*

[Alluvial land (Aa) is omitted from table because its properties are highly variable. An asterisk in the first column indicates that at least for referring to another series in the first column of

Soil series and map symbols	Depth to seasonal water table	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Ft.	*In.*			
Beadle: BaA	>5	0–5	Loam	ML–CL or CL	A–4 or A–6
		5–19	Clay loam	CL or CH	A–7
		19–60	Clay loam	CL	A–6
*Betts: BeE, BhD, BlE. For Ethan part of BeE and BhD, see Ethan series. For Gavins part of BlE, see Gavins series.	>5	0–8	Loam	ML–CL or CL	A–6
		8–30	Clay loam	CL	A–6
		30–66	Clay loam	CL	A–6
*Blendon: BmA, BnA. For Firesteel part of BnA, see Firesteel series.	>5	0–45	Sandy loam	SM or SM–SC	A–2
		45–60	Loamy sand	SP SM or SM	A–2
Bon: BoA	[1] >5	0–32	Loam	ML or ML–CL or CL	A–4 or A–6
		32–60	Stratified sandy loam and loamy sand.	SM or SM–SC	A–2 or A–4
Clamo: Ca, Cc	<3	0–15	Silty clay loam	ML–CL or CL or CH	A–6 or A–7
		15–38	Silty clay	CL or CH	A–7 or A–6
		38–60	Silty clay	CH	A–7
*Clarno: CeB, CeC, ChA, ChB. For Ethan part of CeB and CeC, see Ethan series. For Houdek part of ChA and ChB, see Houdek series.	>5	0–8	Loam	ML–CL or CL	A–4 or A–6
		8–16	Loam	CL	A–4 or A–6
		16–30	Loam	CL	A–4 or A–6
		30–60	Loam	CL	A–6
*Davison: DhA. For Hand part of DhA, see Hand series.	<4	0–9	Loam	ML–CL or CL	A–4 or A–6
		9–34	Clay loam	ML–CL or CL	A–6
		34–40	Stratified silt loam and sandy loam.	ML or SC or CL or ML–CL	A–2 or A–4 or A–6
Delmont: DmB	>5	0–15	Loam	ML–CL or CL	A–4 or A–6
		15–60	Stratified sand and gravel.[2]	SW–SM or SM–SC or GW	A–1 or A–2
*Dudley. Mapped only in complex with Stickney soils.	[1] >5	0–9	Silt loam	ML–CL or CL	A–4 or A–6
		9–25	Clay loam	CL or CH	A–7
		25–60	Clay loam	CL	A–6
*Enet: EnA, EoA, EoB, EsA. For Delmont part of EoA and EoB, see Delmont series. For Storla part of EsA, see Storla series.	>5	0–24	Loam	ML–CL or CL	A–4 or A–6
		24–60	Stratified sand and gravel.[3]	SC, SW, GW, GW-GM	A–1 or A–2
*Ethan: EtC2. For Betts part of EtC2, see Betts series.	>5	0–9	Loam	ML–CL or CL	A–4 or A–6
		9–48	Loam	ML–CL	A–6
		48–60	Loam	CL	A–6

See footnotes at end of table.

significant to engineering

one mapping unit in this series is made up of more than one kind of soil. For this reason the reader should carefully follow the instructions the table. Symbol > means greater than, symbol < means less than]

Percentage less than 3 inches passing sieve—				Perme-ability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					Uncoated steel	Concrete
				In./hr.	*In./in. of soil*	*pH*			
96–100	95–100	90–100	65–80	1. 0–2. 0	0. 18–0. 20	6. 1–7. 3	Low to moderate.	Low	Low.
100	95–100	90–100	75–80	0. 2–0. 6	0. 16–0. 19	6. 6–7. 8	High	Low	Low.
96–100	95–100	85–95	60–80	0. 2–0. 6	0. 14–0. 17	7. 9–9. 0	Moderate to high.	Moderate	Moderate.
96–100	95–100	85–95	60–85	1. 2–2. 0	0. 18–0. 20	7. 3–8. 4	Moderate	Low to moderate.	Low.
95–100	95–100	85–95	60–85	0. 6–1. 2	0. 17–0. 20	7. 9–8. 4	Moderate to high.	Moderate	Moderate.
95–100	95–100	85–95	60–85	0. 2–0. 6	0. 17–0. 20	7. 9–8. 4	Moderate to high.	Moderate	Moderate.
95–100	95–100	60–85	25–40	2. 0–6. 0	0. 11–0. 15	6. 6–7. 3	Low	Low	Low.
95–100	95–100	50–80	10–35	6. 0–10. 0	0. 08–0. 10	6. 6–7. 8	Low	Low	Low.
95–100	95–100	75–95	40–75	1. 2–2. 0	0. 18–0. 20	6. 6–8. 4	Low	Low	Low.
90–100	90–100	50–85	10–40	2. 0–4. 0	0. 09 0. 15	7. 9–8. 4	Low	Low	Low to moderate.
100	100	95–100	90–100	0. 20 0. 6	0. 16–0. 19	6. 6–7. 8	High	Moderate	Moderate.
100	95–100	95–100	85–95	0. 06–0. 2	0. 13–0. 18	7. 9–8. 4	High	Moderate	Moderate.
100	95–100	95–100	90–100	0. 06–0. 2	0. 13–0. 18	7. 9–8. 4	High	Moderate	Moderate.
95–100	95–100	85–95	55–75	1. 2–2. 0	0. 18–0. 20	6. 6–7. 3	Moderate	Low	Low.
95–100	95–100	80–90	55–75	0. 6–1. 2	0. 16–0. 18	7. 4–7. 8	Moderate to high.	Low	Low.
95–100	90–100	80–90	50–80	0. 6–1. 2	0. 16–0. 18	7. 9–9. 0	Moderate to high.	Moderate	Moderate.
95–100	90–100	80–90	50–80	0. 2–0. 6	0. 16–0. 18	7. 9–9. 0	Moderate to high.	Moderate	Moderate.
95–100	95–100	90–100	45–80	1. 2–2. 0	0. 18–0. 20	7. 9–8. 4	Low	Low	Low.
95–100	95–100	85–95	60–90	0. 6–1. 2	0. 17–0. 20	7. 9–9. 0	Moderate	High	Moderate.
90-100	85-95	60–85	30–75	0. 6–2. 0	0. 09–0. 20	7. 9–8. 4	Low to moderate.	High	Moderate.
90–100	90–100	85–95	50–75	1. 2–2. 0	0. 18–0. 20	6. 6–7. 8	Moderate	Low	Low.
45–80	45–70	10–60	5–20	6. 0–20. 0	0. 03–0. 6	7. 9–8. 4	Low	Low	Low.
96–100	95–100	90–100	70–90	0. 6–2. 0	0. 19–0. 22	6. 1–7. 3	Moderate	Low	Low.
95–100	95–100	90–100	75–90	0. 02–0. 2	0. 13–0. 16	6. 6–9. 0	High	High	High.
95–100	95–100	90–100	60–85	0. 06–0. 2	0. 11–0. 14	7. 9–9. 0	Moderate to high.	High	High.
90–100	85–95	75–90	55–75	1. 2–2. 0	0. 18–0. 20	6. 6–7. 8	Low	Low	Low.
70–85	45–70	10–60	3–35	6. 0–20. 0	0. 03–0. 06	7. 9–8. 4	Low	Low	Low.
95–100	95–100	85–95	60–75	1. 2–2. 0	0. 18–0. 20	6. 6–7. 8	Moderate	Low	Low.
95–100	95–100	85–95	60–80	0. 6–1. 2	0. 16–0. 18	7. 9–9. 0	Moderate to high.	Moderate	Moderate.
95–100	95–100	85–95	60–80	0. 2–0. 6	0. 16–0. 18	7. 9–9. 0	Moderate to high.	Moderate	Moderate.

TABLE 5.—*Estimates of soil properties*

Soil series and map symbols	Depth to seasonal water table	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Ft.	*In.*			
Fedora: FeA	2<4	0–40	Sandy loam	SM-SC or SM	A–2 or A–4
		40–66	Stratified sand and sand mixed with gravel.	SW-SM or SM	A–1 or A–2
Firesteel: FsA	<3	0–15	Silt loam	ML–CL or ML	A–4 or A–6
		15–30	Silt loam	ML–CL or ML	A–4 or A–6
		30–60	Bedded siltstone.[4]		
*Gavins. Mapped only in complex with Betts soils.	>5	0–18	Silt loam	ML–CL or ML	A–4 or A–6
		18–60	Bedded siltstone.[5]		
*Hand: HaB, HdA. For Davison part of HdA, see Davison series.	>5	0–22	Loam	ML–CL or CL	A–4 or A–6
		22–32	Clay loam	CL	A–4 or A–6
		32–60	Stratified loamy fine sand, sandy loam, and loam.	SM or ML–CL or CL	A–2 or A–4 or A–6
*Houdek: HkA, HpA, HsA. For Prosper part of HkA and HpA, see Prosper series. For Stickney part of HpA and HsA, see Stickney series.	>5	0–6	Loam	ML-CL or CL	A–4 or A–6
		6–18	Clay loam	CL	A–6
		18–38	Clay loam	CL	A–6
		38–60	Clay loam	CL	A–6
*Lamo: La, LpA. For Prosper part of LpA, see Prosper series.	<3	0–20	Silt loam	ML or ML–CL	A–4 or A–6
		20–66	Stratified silty clay loam, sandy loam, and buried soils.	ML–CL or CL	A–4 or A–6 or A–7
Prosper: PrA, PrB	[1]>5	0–9	Loam	ML–CL or CL	A–4 or A–6
		9–24	Clay loam	CL or CH	A–6 or A–7
		24–45	Clay loam	CL	A–6
		45–60	Clay loam	CL	A–6
Redstoe: ReA, ReC, ReD	>5	0–9	Loam	ML–CL or ML	A–4 or A–6
		9–32	Silt loam	ML or ML–CL	A–6 or A–7
		32–44	Bedded siltstone.[4]		
Salmo: Sa	0–2	0–13	Silt loam	ML or ML–CL	A–4 or A–6
		13–60	Stratified silty clay loam with coarser and finer materials and buried soils.	ML–CL or CL or SC	A–6
*Stickney: SdA. For Dudley part of SdA, see Dudley series.	[1]>5	0–13	Silty clay loam	ML–CL or CL	A–6
		13–24	Clay loam	CL or CH	A–7 or A–6
		24–60	Clay loam	CL	A–6 or A–7
Storla: SoA, StA	>3	0–16	Loam	ML–CL or CL	A–4 or A–6
		16–30	Loam	CL or SC	A–6
		30–66	Stratified loamy sand, sand and gravel.[3]	SW–SM or SM	A–1 or A–2
*Tetonka: TeA, TsA. For Stickney part of TsA, see Stickney series.	<5	0–16	Silt loam	ML or ML–CL	A–4 or A–6
		16–44	Clay	CL or CH	A–7
		44–60	Clay loam	CL	A–6

[1] In wet years the water table rises to within 5 feet of the surface.
[2] Depth to sand and gravel ranges from 10 to 20 inches.
[3] Depth to sand and gravel ranges from 20 to 40 inches.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					Uncoated steel	Concrete
				In./hr.	*In./in. of soil*	*pH*			
95–100	95–100	65–90	20–35	2. 0–4. 0	0. 90–0. 15	7. 9–8. 4	Low	Low	Low.
70–95	60–80	45–60	10–25	6. 0–20. 0	0. 03–0. 06	7. 9–8. 4	Low	Low	Low.
95–100	95–100	95–100	80–95	1. 1–2. 0	0. 17–0. 22	7. 9–8. 4	Low	Moderate	Moderate.
95–100	95–100	95–100	80–100	0. 6–1. 2	0. 14–0. 17	7. 9–9. 0	Moderate to low.	High	Moderate.
95–100	95–100	95–100	80–95	0. 6–2. 0	0. 17–0. 22	7. 0–9. 0	Low to moderate.	Low	Moderate.
95–100	95–100	85–95	45–70	0. 6–2. 0	0. 16–0. 20	7. 4–7. 8	Low	Low	Low.
95–100	95–100	85–95	50 70	0. 6–1. 2	0. 17–0. 20	7. 9–8. 4	Moderate	Low	Low.
95–100	90–100	70–95	30–85	0. 6–2. 0	0. 08–0. 18	7. 3–7. 8	Low	Low	Low.
95–100	95–100	85–100	60–75	1. 2–2. 0	0. 18–0. 20	6. 6–7. 3	Moderate	Low	Low.
95–100	95–100	85–95	60–80	0. 6–1. 2	0. 17–0. 20	6. 6–7. 8	Moderate to high.	Low	Low.
95–100	95–100	85–95	60–75	0. 6–1. 2	0. 17–0. 20	7. 9–8. 4	Moderate to high.	Moderate	Moderate.
95–100	95–100	85–95	60–75	0. 2–0. 6	0. 17–0. 20	7. 9–8. 4	Moderate to high.	Moderate	Moderate.
95–100	95–100	90–100	70–90	0. 6–2. 0	0. 19–0. 22	7. 9–8. 4	Moderate	Low	Moderate.
95–100	95–100	90–100	55–90	0. 2–0. 6	0. 19–0. 22	7. 9–9. 0	Moderate to high.	high	Moderate to High.
95–100	95–100	85–100	55–80	1. 2–2. 0	0. 18–0. 2	6. 1–7. 3	Moderate	Low	Low.
95–100	95–100	85–100	55–85	0. 6–1. 2	0. 19–0. 22	6. 1–7. 8	Moderate to high.	Low	Low.
95–100	95–100	80–90	50–85	0. 6–1. 2	0. 17–0. 2	7. 9–9. 0	Moderate to high.	Moderate	Moderate.
95–100	95–100	80–90	50–85	0. 2–0. 6	0. 17–0. 2	7. 9–9. 0	Moderate to high.	Moderate	Moderate.
95–100	95–100	90–100	70–95	1. 2–2. 0	0. 18–0. 2	7. 9–8. 4	Low	Low	Low.
95–100	95–100	95–100	85–95	0. 6–1. 2	0. 14–0. 17	7. 9–8. 4	Low to moderate.	Moderate	Moderate.
95–100	95–100	90–100	80–90	0. 6–2. 0	0. 19–0. 22	7. 9–8. 4	Moderate	Moderate	Moderate.
95–100	95–100	90–100	40–90	0. 2–0. 6	0. 19–0. 22	7. 9–9. 0	Moderate	High	high.
95–100	95–100	95–100	75–90	0. 6–1. 2	0. 18–0. 22	6. 1–6. 5	Moderate to high.	Low	Low.
95–100	95–100	95–100	85–95	0. 06–0. 2	0. 16–0. 19	6. 1–8. 4	High	High	Moderate.
95–100	95–100	90–100	60–80	0. 2–0. 6	0. 14–0. 17	7. 9–9. 0	Moderate to high.	High	Moderate.
95–100	95–100	85–95	65–75	1. 2–2. 0	0. 18–0. 20	7. 9–8. 4	Low	Low	Low.
95–100	95–100	80–90	45–75	1. 2–2. 0	0. 13–0. 15	7. 9–9. 0	Low to moderate.	Moderate to high.	Moderate.
40–100	40–90	20–60	5–35	6. 0–20. 0	0. 03–0. 08	7. 9–8. 4	Low	Moderate to high.	Moderate.
95–100	95–100	90–100	70–90	0. 6–1. 2	0. 19–0. 22	6. 1–6. 6	Moderate	Low	Low.
95–100	95–100	90–100	65–85	$<$0–06	0. 13–0. 18	6. 6–7. 8	High	High	Moderate.
95–100	95–100	85–95	55–70	0. 06–0. 2	0. 14–0. 17	7. 9–8. 4	Moderate to high.	High	Moderate.

[4] Depth to bedded siltstone ranges from 24 to 40 inches.
[5] Depth to bedded siltstone ranges from 10 to 20 inches.

TABLE 6.—*Interpretations of*

[Alluvial land (Aa) is omitted from table because its properties are highly variable. An asterisk in the first column indicates that at least for referring to another series in

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Dwellings with basements	Sanitary land fill [1]	Local roads and streets
Beadle: BaA	Severe: moderately slow permeability.	Slight	Moderate: moderate to high shrink-swell potential; fair bearing capacity; seepage below depth of 5 feet in wet years.	Moderate: medium to high compressibility; moderate to high shrink-swell potential.	Severe: high shrink-swell potential; medium to high compressibility; high susceptibility to frost heave.
*Betts [2]: BeE, BhD, BlE. For Ethan part of BeE and BhD, see Ethan series. For Gavins part of BlE, see Gavins series.	Severe: slopes generally are more than 15 percent; moderately slow permeability in substratum.	Severe: slopes generally are more than 15 percent.	Severe: slopes generally are more than 15 percent; moderate to high shrink-swell potential.	Moderate on slopes less than 25 percent, severe on slopes more than 25 percent; clay loam texture.	Severe: slopes generally are more than 15 percent; moderate to high shrink-swell potential.
*Blendon: BmA, BnA. For Firesteel part of BnA, see Firesteel series.	Slight: moderately rapid to rapid permeability.[3]	Severe: moderately rapid to rapid permeability.	Slight	Severe: moderately rapid to rapid permeability.	Slight
Bon: BoA	Severe: occasional flooding.	Severe: occasional flooding; moderately rapid to rapid permeability in substratum.	Severe: occasional flooding.	Severe: occasional flooding; moderately rapid to rapid permeability in substratum.	Severe: occasional flooding.
Clamo: Ca, Cc	Severe: slow permeability; occasionally to frequently flooded.	Severe: high water table; occasionally to frequently flooded.	Severe: high shrink-swell potential; occasionally to frequently flooded; high water table.	Severe: occasionally to frequently flooded; high water table.	Severe: high shrink-swell potential; fair to poor stability; occasionally to frequently flooded.
*Clarno: CeB, CeC, ChA, ChB. For Ethan part of CeB and CeC, see Ethan series. For Houdek part of ChA and ChB, see Houdek series.	Severe: moderately slow permeability in substratum.	Slight where slopes are generally less than 3 percent. Moderate where slopes are 3 to 6 percent. Severe where slopes are greater than 6 percent.	Moderate: moderate to high shrink-swell potential; fair bearing capacity; seepage below depth of 5 feet in wet years.	Slight	Severe: moderate to high shrink-swell potential; high susceptibility to frost heave.
*Davison: DhA. For Hand part of DhA, see Hand series.	Severe: stratified substratum of silt loam and sandy loam; moderately high water table.	Severe: stratified substratum of silt loam and sandy loam; moderately high water table.	Severe: moderately high water table.	Severe: moderately high water table.	Severe: low to moderate shrink-swell potential; high susceptibility to frost heave; moderately high water table.

See footnotes at end of table.

engineering properties

one mapping unit in this series is made up of two or more kinds of soil. For this reason the reader should carefully follow the instructions the first column of this table]

Suitability as source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Highway location
Poor: moderate to high shrink-swell potential; high susceptibility to frost heave; medium to high compressibility.	Not suited	Good to depth of 6 inches, fair between depth of 6 to 12 inches.	Slopes are 2 percent or less.	High shrink-swell potential; fair to poor stability and compaction characteristics in subsoil.	Moderately slow permeability; soluble salts in substratum.	Slopes generally are 2 percent or less; moderately slow permeability.	Moderate to high shrink-swell potential.
Poor: moderate to high shrink-swell potential; high susceptibility to frost heave.	Not suited	Poor: thin surface layer.	Slopes generally are more than 15 percent; moderately slow permeability in substratum.	Moderate to high shrink-swell potential; fair to good stability and compaction characteristics in subsoil.	Slopes generally are more than 15 percent.	Slopes generally are more than 15 percent.	Slopes generally are more than 15 percent.
Good	Fair source of sand in substratum; poor source of gravel.	Good	Moderately rapid to rapid permeability.	Fair to poor stability; moderately rapid to rapid permeability after compaction.	Moderate available water capacity; moderately rapid water intake.	Slopes generally are 3 percent or less; moderately rapid permeability.	Low shrink-swell potential; slopes generally are 3 percent or less.
Fair in surface and subsoil, good in substratum.	Poor source of sand and gravel.	Good	Moderately rapid to rapid permeability in substratum.	Poor stability; moderate permeability where compacted.	Occasionally flooded.	Slopes generally are 2 percent or less; occasionally flooded.	Occasionally flooded.
Poor: high shrink-swell potential; high compressibility; fair to poor stability.	Not suited	Poor: poorly drained; silty clay loam texture.	Occasionally to frequently flooded; high water table.	Fair to poor compaction characteristics and stability; poor shear strength.	Occasionally to frequently flooded; slow permeability; salts in subsoil and substratum.	Fair to poor stability.	High shrink-swell potential; occasionally to frequently flooded; poor stability.
Fair to poor: moderate to high shrink-swell potential; fair stability; high susceptibility to frost heave.	Not suited	Good to depth of 8 inches, fair to depths between 8 and 16 inches.	All features favorable.	Fair to good stability; fair to good compaction characteristics; low permeability after compaction.	Salt layers and moderately slow permeability in substratum.	Slopes generally are short and irregular.	Short, irregular slopes; moderate to high shrink-swell potential.
Poor: low to moderate shrink-swell potential; high susceptibility to frost heave.	Generally not suited to sand and gravel.	Fair: lime in surface layer.	Moderate to rapid permeability in substratum.	Moderate to low shrink-swell potential; fair stability.	Moderately high water table; low to medium fertility.	Slopes generally are 3 percent or less.	Slopes generally are 3 percent or less; moderately high water table; high susceptibility to frost heave.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Dwellings with basements	Sanitary land fill [1]	Local roads and streets
Delmont: DmB	Slight [4]	Severe; rapid permeability in substratum.	Slight	Severe: rapid permeability in substratum.	Slight
*Dudley. Mapped only in complex with Stickney soils.	Severe: slow or very slow permeability.	Slight [3]	Severe: [3] high shrink-swell potential; fair to poor bearing capacity.	Moderate: moderately well or somewhat poorly drained.	Severe: high shrink-swell potential.
*Enet: EnA, EoA, EoB, EsA. For Delmont part of EoA and EoB, see Delmont series. For Storla part of EsA, see Storla series.	Slight [4]	Severe: rapid permeability in substratum.	Slight	Severe: rapid permeability in substratum.	Slight
*Ethan: EtC2. For Betts part of EtC2, see Betts series.	Severe: moderately slow permeability in substratum.	Moderate where slopes are 3 to 6 percent. Severe where slopes are more than 6 percent.	Moderate where slopes are 15 percent or less. Severe where slopes are steeper than 15 percent; moderate to high shrink-swell potential.	Slight where slopes are 15 percent or less. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.	Severe for all slopes; moderate to high shrink-swell potential.
Fedora: FeA	Severe: high water table.	Severe: high water table; moderately rapid to rapid permeability.	Severe: high water table.	Severe: high water table; moderately rapid to rapid permeability.	Moderate: high water table.
Firesteel: FsA	Severe: moderately high water table; bedded siltstone at a depth of 20 to 40 inches.	Severe: bedded siltstone from depth of 20 to 40 inches; moderately high water table.	Severe: moderately high water table; moderate to low shrink-swell potential; bedded siltstone from depth of 20 to 40 inches.	Severe: moderately high water table; bedded siltstone from depth of 20 to 40 inches.	Severe: moderate to low shrink-swell potential; high susceptibility to frost heave.

See footnotes at end of table.

engineering properties—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Highway location
Good in substratum.	Good source for sand and gravel; between 10 and 20 inches of overburden.	Good from surface to depth of 10 to 20 inches.	Rapid permeability in substratum.	High permeability after compaction; fair to poor resistance to piping.	Low available water capacity.	Slopes are 3 to 6 percent and are short and irregular; sand and gravel substratum limits channel cuts.	Slopes are 3 to 6 percent and are short and irregular.
Poor: high shrink-swell potential.	Not suited	Good to depth of 9 inches; poor below depth of 9 inches; claypan in subsoils.	Slopes generally are 2 percent or less.	Fair to poor stability; fair to poor compaction characteristics.	Slow to very slow permeability; salts in subsoil and substratum.	Slopes generally are 2 percent or less.	High shrink-swell potential.
Good in substratum.	Good source for sand and gravel, 20 to 36 inches of overburden.	Good	Rapid permeability in substratum.	Rapid permeability after compaction and fair to poor resistance to piping of substratum materials.	Low to moderate available water capacity.	Slopes are 3 to 6 percent and are short and irregular; sand and gravel substratum limits channel cuts.	Slopes are 3 to 6 percent and are short and irregular.
Poor: moderate to high shrink-swell potential.	Not suited	Good to depth of 9 inches; fair below depth of 9 inches.	All features favorable.	Fair to good stability and compaction characteristics; low permeability after compaction.	Moderately slow permeability and salt layers in substratum.	All slopes generally are short and irregular.	All slopes generally are short and irregular.
Fair: high water table; low shrink-swell potential.	Fair to poor: high water table.	Fair to depth of 8 inches; poor below 8 inches; lime in surface layer.	Moderately rapid to rapid permeability; high water table.	Fair to good stability; low shrink-swell potential; moderate to high permeability after compaction.	High water table; low fertility; low to moderate available water capacity.	High water table; slopes generally are less than 3 percent.	High water table; slopes generally are less than 3 percent.
Poor: moderate to low shrink-swell potential; high susceptibility to frost heave.	Not suited	Fair to depth of 7 inches; lime in surface layer.	Moderately high water table; possible seepage in bedded siltstone.	Poor stability; medium compressibility; poor resistance to piping.	Moderately high water table; bedded siltstone from depth of 20 to 40 inches; salts in subsoil.	Slopes generally are less than 3 percent; fair to poor stability.	Moderately high water table; poor compaction characteristics; high susceptibility to frost heave.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Dwellings with basements	Sanitary land fill [1]	Local roads and streets
*Gavins: Mapped only in complex with Betts soils.	Severe: slopes generally are more than 15 percent; depth of 10 to 20 inches to bedded siltstone.	Severe: slopes generally are more than 15 percent; depth of 10 to 20 inches to bedded siltstone.	Severe: slopes generally are more than 15 percent; depth of 10 to 20 inches to bedded siltstone.	Severe: slopes generally are more than 15 percent; depth of 10 to 20 inches to bedded siltstone.	Severe: slopes generally are more than 15 percent; depth of 10 to 20 inches to bedded siltstone.
*Hand: HaB, HdA. For Davison part of HdA, see Davison series.	Moderate: moderate permeability.	Severe: stratified substratum of sandy loam, silt loam, loam, and loamy sands.	Moderate: moderate shrink-swell potential.	Severe: stratified substratum; possible seepage.	Severe: moderate shrink-swell potential.
*Houdek: HkA, HpA, HsA. For Prosper part of HkA and HpA, see Prosper series. For Stickney part of HpA and HsA, see Stickney series.	Severe: moderately slow permeability in substratum.	Slight	Moderate for all slopes; moderate to high shrink-swell potential; fair bearing capacity; seepage below depth of 5 feet in wet years.	Moderate: clay loam textures.	Severe: moderate to high shrink-swell potential.
*Lamo: La, LpA. For Prosper part of LpA, see Prosper series.	Severe: moderately high water table; occasionally flooded.	Severe: moderately high water table; occasionally flooded.	Severe: moderately high water table; occasionally flooded.	Severe: moderately high water table; occasionally flooded.	Severe: moderate to high susceptibility to frost heave; moderately high water table.
Prosper: PrA, PrB	Severe: moderately slow permeability in substratum; frequently flooded for short duration.	Severe: frequently flooded for short duration.	Severe: frequent flooding of short duration; moderate to high shrink-swell potential; fair bearing capacity.	Severe: frequent flooding of short duration. [4]	Severe: moderate to high shrink-swell potential; frequent flooding of short duration.
Redstoe: ReA, ReC, ReD	Severe: depth to bedded siltstone is 20 to 40 inches.	Severe: depth to bedded siltstone is 20 to 40 inches; seepage along cleavage plane of siltstone.	Moderate on slopes less than 15 percent, severe over 15 percent; depth to bedded siltstone is 20 to 40 inches.	Severe: depth to bedded siltstone is 20 to 40 inches; seepage along cleavage plane of siltstone.	Severe for all slopes: high susceptibility to frost heave.

See footnotes at end of table.

engineering properties—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Highway location
Poor: moderate to low shrink-swell potential; high susceptibility to frost heave; depth of 10 to 20 inches to bedded siltstone.	Not suited	Poor: thin surface layer; low fertility.	Slopes generally are more than 15 percent; possible seepage in bedded siltstone.	Poor compaction characteristics; fair to poor stability; medium compressibility; poor resistance to piping.	Slopes generally are more than 15 percent; low fertility.	Slopes generally are more than 15 percent; depth of 10 to 20 inches to bedded siltstone.	Slopes generally are more than 15 percent; depth of 10 to 20 inches to bedded siltstone; moderate to low shrink-swell potential.
Fair: moderate shrink-swell potential; moderate to high susceptibility to frost heave.	Not suited	Good	Possible seepage in substratum.	Moderate shrink-swell potential; fair to poor compaction characteristics.	Stratified substratum material.	Slopes generally are short and irregular.	Slopes generally are less than 6 percent; moderate shrink-swell potential.
Poor: moderate to high shrink-swell potential; high susceptibility to frost heave.	Not suited	Good to depth of 6 inches, fair between depth of 6 to 18 inches.	Slopes generally are less than 6 percent.	Moderate to high shrink-swell potential; fair stability, fair to good compaction characteristics.	Moderately slow permeability and salt layers in substratum.	Slopes generally are short and irregular.	Slopes generally are less than 6 percent; moderate to high shrink-swell potential.
Poor: moderate to high shrink-swell potential; high susceptibility to frost heave.	Not suited	Fair: lime in the surface layer.	Moderately high water table; possible seepage in substratum layers.	Moderate to high shrink-swell potential; fair shear strength; poor stability.	Moderately high water table; salt layers in substratum; occasionally flooded.	Poor stability	Moderately high water table; slopes generally are 2 percent or less; occasionally flooded.
Poor: moderate to high shrink-swell potential.	Not suited	Good	All features generally favorable.	Moderate to high shrink-swell potential; fair shear strength; fair to good compaction characteristics.	Moderately slow permeability and salt layers in substratum.	Fair stability; frequently flooded for short duration.	Frequent flooding of short duration.
Poor: poor compaction characteristics.	Not suited	Fair to depth of 9 inches, poor below 9 inches; lime in the surface layer.	Seepage along cleavage planes in siltstone.	Poor compaction characteristics and resistance to piping; fair to poor shear strength.	Depth to bedded siltstone is 20 to 40 inches; salts in subsoil and bedded siltstone.	Cuts in channel area limited because of bedded siltstone; poor stability.	Depth to bedded siltstone is 20 to 40 inches; poor stability and compaction characteristics.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields.	Sewage lagoons	Dwellings with basements	Sanitary land fill [1]	Local roads and streets
Salmo: Sa	Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.
Stickney: SdA. For Dudley part of SdA, see Dudley series.	Severe: slow permeability in subsoil and substratum.	Slight [3]	Severe: [3] high shrink-swell potential; fair bearing capacity.	Moderate: [3] clay loam subsoil and substratum.	Severe: high shrink-swell potential.
Storla: SoA, StA	Severe: moderately high water table.	Severe: moderately high water table.	Severe: moderately high water table.	Severe: moderately high water table.	Severe: moderately high water table.
*Tetonka: TeA, TsA. For Stickney part of TsA, see Stickney series.	Severe: frequent flooding and ponding of water.	Severe: frequent flooding and ponding of water.	Severe: frequent flooding and ponding of water; high shrink-swell potential.	Severe: frequent flooding and ponding of water.	Severe: high shrink-swell potential; high susceptibility to frost heave; frequent flooding and ponding of water.

[1] Onsite deep studies of the underlying strata, water table, and the hazards of acquifer pollution and drainage into ground water need to be made for landfills deeper than 5 or 6 feet.

[3] In some places small areas are covered by boulders and large stones.

engineering properties—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Highway location
Poor: high susceptibility to frost heave; moderate shrink-swell potential.	Generally not suited.	Poor: moderate salinity in surface and subsoil layers.	Frequent flooding; high water table; stratified substratum.	Fair to poor stability and compaction.	Moderate salinity in surface and subsoil layers; high water table; frequent flooding.	Fair to poor stability; slopes are less than 2 percent.	Frequent flooding; high water table; moderate shrink-swell potential.
Poor: high shrink-swell potential; fair compaction.	Not suited____	Good to depth of 7 inches.	Slopes generally are less than 2 percent.	High shrink-swell potential; poor shear strength; fair to poor compaction characteristics.	Slow permeability and salts in subsoil and substratum.	Fair to poor stability; slopes generally are less than 2 percent.	Slopes generally are less than 2 percent; high shrink-swell potential.
Poor: moderately high water table; low shrink-swell potential; susceptibility to frost heave.	Fair for sand and gravel.	Fair: lime in surface layer.	Rapid permeability in substratum.	Rapid permeability; fair to poor resistance to piping and fair stability of substratum material.	Moderately high water table; salt layers in subsoil; low fertility.	Cuts in channel areas limited by sand and gravel in substratum.	Moderately high water table; slopes generally are less than 3 percent.
Poor: high shrink-swell potential; high susceptibility to frost heave; high compressibility.	Not suited____	Poor: poorly drained.	Frequent flooding and ponding of water; good dugout sites.	High shrink-swell potential; high susceptibility to frost heave; poor shear strength.	Frequent flooding and ponding of water; slow permeability.	Not applicable.	Frequent flooding and ponding of water; high shrink-swell potential; high susceptibility to frost heave.

[3] In wet years the water table is within 5 feet of the surface; most of the time it is more than 5 feet from the surface.
[4] Rapid permeability of substratum may result in possible contamination of ground water.

TABLE 7.—*Engineering*

[Tests performed by the South Dakota Department of Highways in cooperation with the U.S. Department of Commerce, Bureau of Public

Soil name and location	Parent material	Depth	Moisture density [1]	
			Maximum dry density	Optimum moisture
		In.	*Lb. per cu. ft.*	*Pct.*
Beadle loam: 0.28 mile N. and 118 feet E. of the SW. corner, sec. 21, T. 102 N., R. 62 W. (Modal)	Glacial till.	10–19	103	18
		19–34	108	17
		34–60	107	17
Betts loam: 318 feet N. and 246 feet E. of the SW. corner, sec. 35, T. 104 N., R. 60 W. (Modal)	Glacial till.	11–17	107	17
		26–60	110	16
Clamo silty clay: 0.7 mile E. and 255 feet N. of SW. corner, sec. 35, T. 104 N., R. 60 W. (Modal)	Clayey alluvium.	6–12	89	29
		34–60	85	31
Delmont loam: 90 feet E. and 340 feet N. of the SW. corner, sec. 31, T. 104 N., R. 61 W. (Modal)	Gravelly glacial outwash.	5–12	105	19
		12–23	132	10
		23–60	121	13
Enet loam: 250 feet W. and 0.18 mile N. of the SE. corner, sec. 15, T. 102 N., R. 60 W. (Modal)	Gravelly glacial outwash.	5–22	111	15
		27–45	119	12
		45–60	117	6
Ethan loam: 0.2 mile E. and 168 feet N. of the SW. corner, sec. 25, T. 103 N., R. 61 W. (Thinner A horizon)	Glacial till.	5–11	103	18
		11–21	111	15
		21–60	114	14
Firesteel silt loam: 0.3 mile N. and 72 feet E. of the SW. corner, sec. 31, T. 104 N., R. 61 W. (Modal)	Local alluvium over Niobrara siltstone.	6–15	90	27
		15–30	87	30
		30–60	80	37
Hand loam: 0.15 mile E. and 435 feet S. of the NW. corner, sec. 3, T. 103 N., R. 60 W. (Modal)	Loamy glacial outwash.	6–12	111	16
		12–19	112	16
		26–60	112	16
0.25 mile E. and 525 feet S. of the NW. corner, sec. 2, T. 103 N., R. 60 W.	Loamy glacial outwash.	0–7	107	17
		14–24	109	15
		38–60	115	15
Houdek loam: 0.1 mile S. and 470 feet W. of the NE. corner, sec. 26, T. 103 N., R. 61 W. (Modal)	Glacial till.	6–11	105	17
		18–32	116	14
		32–60	114	14
Prosper loam: 225 feet E. and 99 feet N. of the SW. corner, sec. 28, T. 103 N., R. 62 W. (Modal)	Glacial till.	8–23	107	16
		30–41	109	16
		41–60	110	16
Stickney silt loam: 185 feet N. and 400 feet W. of the SE. corner, sec. 24, T. 101 N., R. 62 W. (Modal)	Glacial till.	0–9	98	22
		12–25	99	21
		41–60	105	19
1855 feet S. and 355 feet E. of the NW. corner, sec. 22, T. 101 N., R. 62 W. (Modal)	Glacial till.	0–7	100	21
		14–25	101	21
		43–60	113	15
Tetonka silt loam: 2502 feet E. and 162 feet S. of the NW. corner, sec. 33, T. 103 N., R. 62 W. (Modal)	Local alluvium over glacial till.	10–24	106	19
		24–32	108	18
		41–60	112	16

[1] Based on AASHO Designation T 99 (*1*).

[2] Mechanical analyses according to the AASHO Designation: T 88–57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses data shown in this table are not suitable for use in naming textural classes for soils.

test data

Roads (BPR), in accordance with standard procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [2]					Liquid limit	Plasticity index	Classification	
Percentage passing sieve—				Percentage smaller than 0.005 mm.			AASHO [3]	Unified [4]
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
					Pct.			
100	100	96	78	39	46	24	A-7-6(14)	CL
99	98	93	76	36	40	20	A-6(12)	CL
98	96	89	71	34	39	19	A-6(11)	CL
98	97	91	65	28	35	14	A-6(6)	CL
98	96	90	66	25	33	13	A-6(7)	CL
100	100	100	97	57	71	41	A-7-6(20)	CH
100	100	100	96	63	83	52	A-7-5(20)	CH
97	93	78	48	16	35	13	A-6(4)	ML-CL
66	48	22	8	2	25	1	A-1-a(0)	SW-SM
72	47	18	6	1	(5)	(5)	A-1-a(0)	SW-SM
91	87	77	49	20	33	15	A-6(5)	SC
88	64	26	7	3	(5)	(5)	A-1-b(0)	GW-GM
82	55	13	3	0	(5)	(5)	A-1-b(0)	GW
100	99	94	72	24	40	16	A-6(10)	ML-CL
98	96	91	70	27	31	13	A-6(8)	CL
99	98	92	68	22	29	10	A-4(7)	CL
100	100	98	94	73	46	15	A-7-5(11)	ML
100	100	100	97	77	45	17	A-7-6(12)	ML-CL
100	100	99	97	77	49	16	A-7-5(12)	ML
99	98	89	44	21	33	15	A-6(4)	SC
96	95	87	55	26	35	17	A-6(7)	CL
97	96	89	65	30	37	20	A-6(10)	CL
99	98	94	51	20	28	9	A-4(3)	CL
100	100	99	65	20	28	10	A-4(6)	CL
97	94	87	60	23	30	11	A-6(6)	CL
99	96	91	68	27	36	12	A-6(8)	ML-CL
98	96	91	69	27	31	12	A-6(8)	CL
98	96	90	65	22	29	10	A-4(6)	CL
99	98	93	69	30	37	15	A 6(9)	CL
99	97	93	74	30	34	15	A-6(10)	CL
99	97	92	71	29	35	16	A-6(10)	CL
100	100	98	86	31	37	13	A-6(9)	ML-CL
99	98	95	82	40	47	26	A-7-6(15)	CL
100	99	95	79	36	41	22	A-6(13)	CL
100	100	98	86	29	37	13	A-6(9)	ML-CL
100	100	97	87	41	47	25	A-7-6(15)	CL
99	98	91	68	26	35	18	A-6(10)	CL
100	99	95	78	42	48	30	A-7-6(18)	CL
100	99	93	71	37	43	26	A-7-6(15)	CL
99	97	91	67	28	36	19	A-6(10)	CL

[3] Based on The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation M145-49 (*1*).

[4] Based on the Unified Soil Classification System (*10*): SCS and BPR have agreed to consider that all series having plasticity indexes within two points of the A-lines are to be given a borderline classification. An example of a borderline classification obtained by this use is ML-CL.

[5] Nonplastic.

TABLE 8.—*Engineering test data from soil samples*

[Tests made by South Dakota Department of Highways. Absence

Soil series	Horizon	Number of samples tested	Mechanical analysis [1]					
			Percentage less than 3 inches passing sieve—					
			No. 10 (2.0 mm.)		No. 40 (0.42 mm.)		No. 200 (0.074 mm.)	
			Range	Average	Range	Average	Range	Average
Betts.	C	4	94–98	96	82–93	88	54–70	61
Blendon.	A	1	100	----------	90	----------	25	----------
	B	1	100	----------	87	----------	34	----------
	C	3	95–97	96	59–75	66	14–16	15
Bon.	A	1	94	----------	60	----------	45	----------
	C	2	98–99	99	89–96	93	15–26	21
Clamo.	B	4	100	100	98–100	99	89–96	92
	C	1	100	----------	100	----------	76	----------
Clarno.	A	2	98	98	90–93	92	54–59	57
	B	10	87–100	96	80–96	90	57 94	69
	C	4	93–99	96	86–94	91	65–70	67
Delmont.	B	2	60–85	73	27–70	49	10–31	21
	C	5	72–98	80	24–82	46	7–42	20
Enet.	A	3	91–97	94	76–84	79	51–59	55
	B	5	91–100	96	64–88	75	36–69	51
	C	13	53–100	76	20–76	41	8–34	17
Houdek.	A	13	96–99	98	88–94	92	53–94	66
	B	22	93–100	98	88–97	92	47–84	64
	C	81	85–100	96	76–98	90	53–93	67
Lamo.	A	1	100	----------	94	----------	67	----------
	B	1	100	----------	98	----------	66	----------
	C	1	100	----------	86	----------	55	----------
Prosper.	A	4	95–100	98	88–96	93	53–78	64
	B	6	94–100	98	86–98	93	58–83	67
	C	18	94–100	97	86–97	92	52–85	69
Stickney.	A	1	99	----------	96	----------	77	----------
	B	2	100	100	99	99	82–93	88
	C	1	98	----------	93	----------	73	----------
Tetonka.	B	4	97–100	99	79–94	88	55–75	67

[1] Mechanical analyses according to the AASHO Designation: T 88–57 (*1*). Results by this procedure may differ somewhat from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by hydrometer method, and the various grain-size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-size fractions. The mechanical analysis data shown in this table are not intended for naming textural classes of soils.

[2] Based on AASHO Designation T 89–60 (*1*).

taken along proposed highway routes

of data in column indicates the soil was not tested for the property]

Liquid limit [2]		Plasticity index [3]		Classification			Estimated ratio [7]
Range	Average	Range	Average	AASHO [4] (old index)	AASHO [5] (new index)	Unified [6]	
		Pct.	*Pct.*				
26–37	33	9–21	16	A-6(8)	A-6(7)	CL	7
20	------------	3	------------	A-2-4(0)	A-2-4(0)	SM	(8)
22	------------	4	------------	A-2-4(0)	A-2-4(0)	SM-SC	(8)
18–21	20	2–4	3	A-2-4(0)	A-2-4(0)	SM	(8)
34	------------	15	------------	A-6(3)	A-6(3)	SC	7
22–25	24	5–7	6	A-2 4(0)	A-2-4(0)	SM-SC	(8)
52–59	56	31–39	35	A-7-6(19)	A-7-6(35)	CH	3
51	------------	29	------------	A-7-6(18)	A-7-6(22)	CH	3
30–32	31	6–10	8	A-4(4)	A-4(3)	ML-CL	8
25–38	33	6–14	10	A-4(7)	A-4(6)	ML-CL	7
24–30	27	6–9	7	A-4(6)	A-4(3)	ML-CL	10
23–25	24	9	9	A-2-4(0)	A-2-4(0)	SC	(8)
18–28	22	1–11	5	A-1-b(0)	A-1-b(0)	SM-SC	(8)
33–37	35	8–11	9	A-4(4)	A-4(3)	ML-CL	6
29–43	35	13–19	16	A-6(5)	A-6(5)	CL	6
20–33	26	0–16	9	A-2-4(0)	A-2-4(0)	SC	(8)
30–37	34	10–16	13	A-6(7)	A-6(7)	CL	7
29–42	34	11–22	16	A-6(8)	A-6(8)	CL	7
25–44	34	5–27	17	A-6(9)	A-6(9)	CL	7
38	------------	14	------------	A-6(8)	A-6(8)	ML-CL	6
30	------------	9	------------	A-4(6)	A-4(4)	ML-CL	8
28	------------	7	------------	A-4(4)	A-4(2)	ML-CL	10
34–42	38	12–19	15	A-6(8)	A-6(8)	ML-CL	6
30–40	35	12–17	15	A-6(8)	A-6(8)	CL	6
24–45	34	6–28	17	A-6(10)	A-6(9)	CL	7
43	------------	18	------------	A-7-6(12)	A-7-6(14)	ML-CL	4
44–57	51	23–37	30	A-7-6(18)	A-7-6(28)	CH	3
37	------------	20	------------	A-6(12)	A-6(12)	CL	6
39–51	44	18–28	25	A-7-6(13)	A-7-6(15)	CL	4

[3] Based on AASHO Designation T 90-61 (*1*).
[4] Based on AASHO Designation M 145-49 (*1*).
[5] Based on AASHO Designation M 145-661 (*1*).
[6] Based on the Unified Soil Classification System (*10*).
[7] Estimated values based on relationships between California bearing ratio (CBR) and liquid limit.
[8] California bearing ratio (CBR) and liquid limit relationship is not applicable to granular classifications A-1, A-2, and A-3 and to subgroups of these classifications.

Road fill is material used as an embankment to support the subbase and the base course or surface course. The ratings indicate performance of soil material moved from borrow areas for these purposes.

Topsoil is soil material needed for the growing of plants to stabilize and control erosion on embankments, in ditches, on shoulders of highways, and on cut slopes. It is used for establishing lawns and gardens. Soils are rated according to their texture, consistence, and thickness.

Ratings as sources of sand and gravel are based mainly on the probability that the areas shown on the map contain deposits of sand and gravel and, to a lesser degree, on the quality of the deposit. Thickness of the deposit and depth of overburden are not given consideration. Extensive exploration and testing generally are needed to determine the acceptability of the deposit for its intended use.

Pond reservoir areas are affected mainly by the seepage loss of water and the soil textures that affect such seepage. Slope affects the storage capacity of the surface area, and the design of embankments of water storing facilities.

Soil features such as shrink-swell potential, shear strength, compaction characteristics, and permeability after compaction determine the use of soil material for embankments, dikes, and levees. The topsoil is first removed because of the organic matter content in this layer, and only the subsoil and underlying materials are used.

Irrigation of soils is affected by the permeability, the available water capacity, the presence of restrictive layers such as a claypan, the depth to water table, flooding, the presence of salt layers, and the slope of the soil. Each feature must be evaluated for the long-term productivity of the soil, even though short-term gains appear promising. The amount and quality of irrigation water is not considered in this table.

Terraces and diversions are used to control erosion and to divert water on sloping land. Permeability, depth to limiting layers, and the steepness, length, and regularity of slopes are features that determine design and workability of these structures.

The undisturbed soil profile, with the surface soil removed, is used in determining features that affect highway location. These features include depth to water table, stability and erodibility of slopes, flooding hazards, shrink-swell potential, and susceptibility to frost heave.

Features affecting the use of soils for septic tank absorption fields, sewage lagoons, dwellings with basements, sanitary landfills, and local roads and streets are discussed in the section "Town and Country Planning."

Engineering test data

Table 7 presents data obtained by laboratory tests on samples from 14 soil profiles. Tests were performed by the South Dakota Department of Highways in cooperation with the U.S. Bureau of Public Roads. They were conducted in accordance with standard procedures of the American Association of State Highway Officials. Some terms used in table 7 are explained in the following paragraphs.

Maximum dry density of a soil is the maximum unit of dry weight of the soil when it has been compacted with optimum moisture by a prescribed method of compaction. The moisture content which gives the highest dry unit weight is the *optimum moisture* for the specific method of compaction.

Mechanical analyses show the percentages, by weight, of soil particles that will pass sieves of specified sizes. Sand and larger size particles do not pass through the No. 200 sieve. The silt and clay passes the No. 200 sieve. Percentages of fractions smaller than those passing through a No. 200 sieve were determined by the hydrometer method, rather than by the pipette method that most soils scientists use in determining the percentage of clay in soil samples.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil materials. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material passes from a solid to a plastic. The *liquid limit* is the moisture content at which the material changes from a plastic to a liquid. The *plasticity index* is the numerical difference between the liquid limit and plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Table 8 presents results of laboratory tests on soil samples taken along the routes of proposed highways. Tests were performed by the South Dakota Department of Highways. The samples were taken at depth breaks that reflected distinct changes in color and, therefore, may include material from more than one major horizon of a given series.

From one to several samples of each horizon of the selected soils were tested. Table 8 shows the actual range and the average value for each of the several properties. The AASHO and Unified classifications listed at the end of the table were based on the average values.

Town and Country Planning

Soils information is an important factor in planning the use or development of land for nonfarm purposes. Information needed for these purposes differs somewhat from that needed for farming. Land appraisers, realtors, city planners, builders, and others need facts that will help them determine what soils are suitable for homes and other buildings and what areas are best suited to other purposes. This information is obtained by using the soil maps to identify the soils and then referring to the sections on soil descriptions, engineering characteristics, and engineering interpretations. It should be emphasized, however, that it is desirable to make detailed sampling and testing at the exact site.

Sites for homes and light industrial buildings.—Soil properties have an important effect on the suitability of a site, a subdivision, or an individual home. Table 5 gives information on texture, permeability, shrink-swell potential, and the Unified soil classification of the soils in the county. The Unified classification system groups soils with respect to their limitations for foundation material. Soils in groups GW, SW, GM, GC, SM, and SC have slight limitations; soils in groups ML and CL have moderate limitations; and those in groups CH and MH have severe limitations. In addition, depth to water table, flooding, slope, and erosion hazard must be considered.

Information on soil features affecting dwellings with basements is given in table 6.

Homes built on poorly drained or wet soils, such as Lamo, Salmo, or Clamo soils, are likely to have wet basements unless artificial drainage is provided. Blendon, Delmont, and Enet soils are examples of soils that provide good foundations.

Erosion and accumulation of sediment are serious hazards in construction areas on sloping soils. Exposed cuts, paving, and compaction of soil materials increase runoff to from two to 10 times the amount leaving the same area while it was in crops or native grass. The concentration and high runoff results in flooding and deposition of sediment in streams and low areas. Sloping areas of Betts, Ethan, and Gavins soils are particularly susceptible to rapid runoff and erosion.

Recreational areas.—This information applies to the suitability of soils for such uses as camp sites, athletic areas, golf courses, playground areas, picnic areas, and paths and trails. Gentle slopes, good drainage, and a surface soil texture that has good qualities for foot traffic are required. In addition, flooding, depth to bedrock, and stones are limitations. The soil descriptions given in the section "Descriptions of the Soils" provide information on these characteristics.

Blendon, Clarno, Delmont, Enet, Hand, and Houdek are examples of soils that have desirable textures for recreation areas. Clamo, Fedora, Lamo, and Salmo are examples of soils where wetness, water table, or flooding hazards prohibit their use for recreational areas.

Septic tank absorption fields.—The major soil properties that affect this use are soil permeability, depth to bedrock, flooding, depth to water table, and slope. Ratings for the soils for septic tank absorption fields are listed in table 6.

Information on soil permeability is given in table 5. Gravelly soils with rapid permeability, such as Delmont and Enet soils, can allow unfiltered effluent and contaminate ground water supplies. A high water table prevents septic tank absorption fields from functioning properly, and it can cause unfiltered effluent to contaminate ground water. Bon, Clamo, Fedora, Storla, and Tetonka are examples of soils that lack good drainage because of wetness or a high water table.

Sewage lagoons.—Soil texture, permeability, wetness hazards, depths to bedrock, and slope are the principal soil properties that affect this use. Soil ratings for sewage lagoons are given in table 6. Seepage from sewage lagoons constructed from unsuitable soil material is one cause of pollution. Blendon, Delmont, and Enet soils are examples of soils with moderately rapid to rapid permeability that will need a backfill of impervious materials to prevent seepage. Soils with slow to very slow permeability, such as the Beadle, Dudley, and Stickney soils, are well suited to sewage lagoons.

Local roads and streets.—Of special interest to homeowners and developers is the suitability of the soils for streets, roads, driveways, and parking lots. The main soil properties that affect this use are wetness, flooding hazard, slope, depth to bedrock, shrink-swell potential, susceptibility to frost heave, and stoniness. In addition, the Unified classification groupings of the soils listed in table 5 provide an indication of their traffic-supporting capacity. The GW, GP, SW, SP, GM, and SM groups have slight limitations for local roads and streets; the CL and ML groups have moderate limitations; and the CH and MH groups have severe limitations.

The estimates of shrink-swell potential in table 5 and interpretations for road fill and highway location in table 6 provide useful information about soils for construction of local roads and streets. Examples of soils in Davison County with problems of wetness and flooding are Bon, Clamo, Davison, Fedora, Lamo, Salmo, and Tetonka soils. Soils in the Beadle, Dudley, and Stickney series have a high shrink-swell potential. When built on high shrink-swell soils, driveways, sidewalks, streets, and roads shift and crack.

Sanitary landfills.—In selecting sites for sanitary landfills, it is important to consider soil slope and drainage. Other factors to consider are texture, permeability, flooding hazard, and stoniness. The section "Descriptions of the Soils" gives information on those characteristics.

Soils that have a texture of sandy loam or loam are well suited to sanitary landfill sites, but these soils are subject to soil blowing. Soils that have a texture of silty clay or clay are very hard when dry, and they have moderate to high shrink-swell potential. They are sticky and plastic when wet and are susceptible to frost heave. Soils that contain large amounts of gravel and sand are loose and incoherent when dry and have poor compaction or stability unless binding material is added.

Soil surveys are a valuable tool in selecting potential or alternate sites for sanitary landfill. They are not a substitute for detailed geologic investigations, because soil borings generally are limited to 5 to 6 feet. In some areas the soil properties below 5 or 6 feet can be predicted with a reasonable degree of accuracy. The design engineer, however, needs to determine actual conditions to obtain valid data for design purposes.

Formation and Classification of the Soils

This section consists of two main parts. The first part tells how the factors of soil formation have affected the development of soils in Davison County. The second explains the system of soil classification currently used and places each soil series in the classes of that system.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The

parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Climate

The climate of Davison County is characteristic of a continental type. Winters are cold, and summers are hot. Periods of drought followed by periods of high precipitation are common, so that the soils are alternately dry and moist. The relatively cool temperature is favorable for the accumulation of organic matter in the surface layer of soils. The amount of precipitation is such that carbonates commonly are leached out of the A and B horizons and are accumulated in the lower part of the B and in the C horizon. Detailed information on climate is given in the section "General Nature of the County."

Plant and animal life

All plants and animals in and on the soil, including bacteria and fungi, contribute to soil formation. In Davison County mid and tall prairie grasses have had more influence on soil formation than other plants and animals. As a result, the soils contain a moderate to high amount of organic matter.

Parental material

Parent material is the unconsolidated mass in which a soil is formed. Davison County soils are formed in glacial till, in glacial melt-water deposits, in material weathered from siltstone of the Niobrara Formation, and in alluvium.

Soils formed in glacial till, for example, the Betts, Houdek, Prosper, and Stickney soils, are the most extensive. These soils have a wide range of characteristics. Soils formed in glacial melt-water deposits generally are loamy and are underlain by sand and gravel or by stratified sand and silt. Examples of these soils are the Davison, Delmont, and Enet soils. Loamy and silty soils formed in material weathered from siltstone of the Niobrara Formation are calcareous at or near the surface. Firesteel, Gavins, and Redstoe are soils wholly or in part formed in this material. Bon, Clamo, and Lamo soils are examples of soils formed in alluvium.

Relief

Relief influences soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. The Betts soils are examples of the steeper soils that lose much of the rainfall through runoff. Such soils form slowly because natural erosion is active. Where slopes are more gentle, runoff is slower, and more water enters the soils. Soil formation progresses and results in such soils as the Clarno, Ethan, and Houdek. Soils such as those of the Prosper series are in positions that receive additional moisture. They have thicker A and B horizons and generally are leached of lime to a greater depth than other soils. Where runoff is ponded, soil-forming processes are altered, resulting in soils such as Tetonka soils.

Time

Time is required to change parent material to soil. Soils that have little or no horizon development are immature, and those that have distinct soil horizons are mature. Beadle and Houdek soils are examples of mature soils that have well-developed horizons. Betts soils, formed in the same kind of material as that in which the Beadle and Houdek soils formed, are immature. The youngest soils, such as Clamo and Lamo, formed in recent alluvium.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge to farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*6*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties and was adopted in 1965 (*8*). It is under continual study (*4* and *9*).

The current system of classification has six caegories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 9 shows the classification of each soil series of this county by family, subgroup, and order, according to the current system.

ORDER: Ten soils orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate these soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different kinds of climate. Table 9 shows that the two soil orders in Davison County are Entisols and Mollisols.

Entisols are light-colored soils that do not have natural genetic horizons or that have only very weakly expressed beginnings of such horizons. These soils do not have

TABLE 9.—*Soils classified according to the current system*

[The classifications are those of the period during which the survey was written]

Soil series	Family	Subgroup	Order
Beadle	Fine, montmorillonitic, mesic	Typic Argiustolls	Mollisols.
Betts	Fine-loamy, mixed (calcareous), mesic	Typic Ustorthents	Entisols.
Blendon	Coarse-loamy, mixed, mesic	Pachic Haplustolls	Mollisols.
Bon	Fine-loamy, mixed, mesic	Cumulic Haplustolls	Mollisols.
Clamo	Fine, montmorillonitic, mesic	Cumulic Haplaquolls	Mollisols.
Clarno	Fine-loamy, mixed, mesic	Typic Haplustolls	Mollisols.
Davison	Fine-loamy, mesic	Aeric Calciaquolls	Mollisols.
Delmont	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Udic Haplustolls	Mollisols.
Dudley	Fine, mixed, mesic	Typic Natrustolls	Mollisols.
Enet	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Pachic Haplustolls	Mollisols.
Ethan	Fine-loamy, mixed, mesic	Entic Haplustolls	Mollisols.
Fedora	Coarse-loamy, mesic	Typic Calciaquolls	Mollisols.
Firesteel	Fine-loamy, mesic	Aeric Calciaquolls	Mollisols.
Gavins	Loamy, mixed (calcareous), mesic, shallow	Typic Ustorthents	Entisols.
Hand	Fine-loamy, mixed, mesic	Typic Haplustolls	Mollisols.
Houdek	Fine-loamy, mixed, mesic	Typic Argiustolls	Mollisols.
Lamo	Fine-silty, mixed (calcareous), mesic	Cumulic Haplaquolls	Mollisols.
Prosper	Fine-loamy, mixed, mesic	Pachic Argiustolls	Mollisols.
Redstoe	Fine-silty, mixed, mesic	Typic Calciustolls	Mollisols.
Salmo	Fine-silty, mixed (calcareous), mesic	Cumulic Haplaquolls	Mollisols.
Stickney	Fine, mixed, mesic	Glossic Natrustolls	Mollisols.
Storla	Fine-loamy over sandy or sandy-skeletal, mesic	Aeric Calciaquolls	Mollisols.
Tetonka	Fine, montmorillonitic, mesic	Argiaquic Argialbolls	Mollisols.

traits that reflect soil mixing caused by shrinking and swelling.

Mollisols have formed under grass and have a thick, dark-colored surface horizon containing colloids dominated by bivalent cations. The material in these soils has not been mixed by shrinking and swelling.

SUBORDER: Each order has been subdivided into suborders, primarily on the basis of the characteristics that seemed to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. Suborders are not shown in table 9.

GREAT GROUPS: Suborders are separated into great groups on basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that contain a pan that interferes with the growth of roots or movement of water. The features used are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 9, because it is the last word in the name of the subgroup.

SUBGROUP: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the great group.

FAMILY: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

General Nature of the County

Davison County was created in 1873 by an act of the Dakota Territory legislature. It was named for Henry Davison, an early pioneer. The boundaries of the originally constituted county included the northern parts of the present Davison and Hanson Counties. The present boundary of the county was designated by the 1881 territorial legislature following a series of adjustments to conform to the wishes of the settlers.

The first settlers of record arrived in 1872 and in 1873. The settlement of Firesteel was first designated the county seat of government. However, the county seat was moved to Mitchell in 1879. Communities that had their beginning with the coming of the railroads were Ethan, Loomis, Mount Vernon, and Mitchell. The early settlement of Firesteel was abandoned after having been bypassed by the railroad.

Despite the hardships experienced by the early settlers, the county was rapidly settled. The population in 1880 was 1,256, and by 1890 it was 5,449. A peak in population was reached in 1930, when the population of the county was 16,821. Since that time the population has

been relatively stable because losses in rural population have been offset by gains in the population of Mitchell. In 1960, 75 percent of the population was classified as urban and 17.5 percent as rural-farm.

Two railroads are in the county, and Mitchell is served by several interstate and intrastate trucking lines. One commercial airline serves Mitchell with connecting flights daily to all parts of the country. One bus company also serves Mitchell. Interstate highway 90, extending from east to west, bisects the county. Other highways in the county are U.S. Highway No. 16 and State Routes No. 37 and 42. Most of the county roads are graded, and many of them either have bituminous surface or are graveled to provide easy access for rural people to centers of trade.

Many of the farm products are marketed in the county. Two auction barns and a meat packing plant in Mitchell are local markets for livestock. Grain elevators are in Betts, Ethan, Loomis, and Mount Vernon, in addition to those in Mitchell. Other outlets for farm products consist of a dairy processor that manufactures infant dietary formulas, creameries, commercial Grade A dairies, feed and seed mills, and bakeries.

School reorganization has closed many of the one-room rural schools. The county is served by three 12-year public school systems in Ethan, Mitchell, and Mount Vernon. In addition, Mitchell is the site of Dakota Wesleyan University. A daily newspaper is published in Mitchell, and the city has radio and television stations. Outstanding among the attractions in Mitchell is the "Corn Palace," which attracts many visitors from all parts of the country.

Hunting and fishing are popular recreational activities in the county. Facilities for golf, bowling, and spectator sports are available in Mitchell.

Climate of Davison County[7]

Davison County has a continental-type climate that is characterized by cold winters and warm to hot summers. There are neither large bodies of water nearby nor other topographical features that materially affect the climate. The climatic summary for this county is based on 70 years (1896–1965) of weather records kept in Mitchell, which is in the east-central part of the county at an elevation of 1,346 feet. There is little climatic gradient across the county; therefore, the climate of Mitchell should be representative for the county. The average annual temperature varies less than one degree, and the annual precipitation varies less than one-half inch over the county. The climate is a limiting factor in the production of most crops in the county.

The temperature range from summer to winter, and at times from day to day, is large in the county. Summer temperatures occasionally climb to above 100°F. In winter temperatures may drop to 30° below zero, or lower. A reading of 100° or higher may be expected on the average about 5 times in 2 years in July, a little more than once a year in August, and a little less than once a year in June. Temperatures of 30° below zero or lower may be expected about once in 4 years in February. Twenty degrees below zero or lower may occur on about 1 day each year in January and in February. On the average, temperatures will drop to zero or lower on 26 days per year and fail to climb above zero at least one day per year.

Table 10 shows the probability of certain low temperatures occurring after specified dates in spring or before indicated dates in fall. According to the table, the probability is 50 percent that a 32° F. temperature will occur on or after May 8. In other words, in about 5 years out of 10 a temperature of 32° or lower can be expected at Mitchell on May 8 or later.

Similarly, table 10 shows the probability is 10 percent that a temperature of 32° or lower will occur by September 11. Thus, on the average, in 1 year out of 10 it will freeze in Mitchell on or before this date. These figures refer to air temperatures as measured in a standard instrument shelter. Soil and plant temperatures vary somewhat from the temperature of the free air.

Other temperature summary data are given by month in table 11. Figure 15 provides average weekly temperatures during 1897–1954 for Mitchell. These data were adapted from Agricultural Economics Pamphlet 68 (*3*).

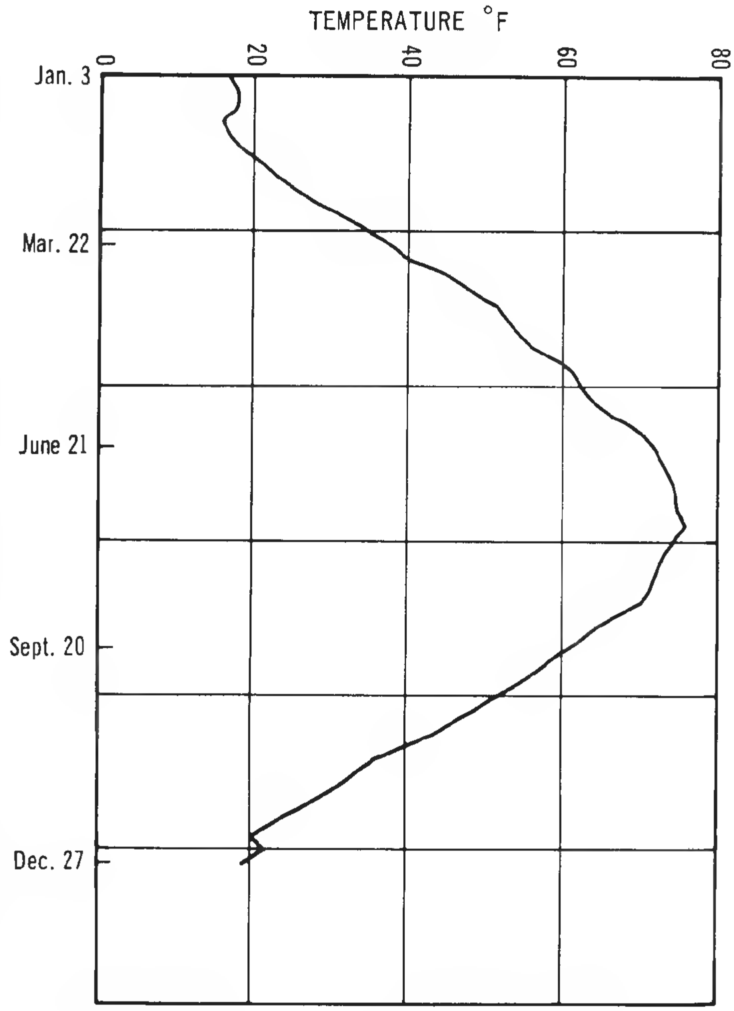

***Figure 15.*—Weekly average temperature for Mitchell, S. Dak., 1897–1954.**

[7] By WALTER SPUHLER, State climatologist, National Weather Service, U.S. Department of Commerce.

Other data on temperature and precipitation are given, by month, in table 11. Average annual precipitation at Mitchell is 22.35 inches of which 17.32 inches, or 77 percent, falls during the growing season (April-September). The annual precipitation ranged from 11.60 inches in 1925 to 36.14 inches in 1908. The main source of rain during the growing season is thundershowers, which produce a wide range of rainfall intensities and amounts. A rainfall of 1 inch or more in 1 hour can be expected about once each year. Two inches of rain in 1 hour can be expected about once in 8 years. About once in 2 years, a 24-hour rain of 2 inches or more can be expected; and about once in 10 years, a 24-hour rain of 3 inches or more can be expected.

A snow cover is important for protecting fall-seeded grains and pastures, although it interferes with farm activities during winter. The average seasonal snowfall at Mitchell is 32 inches. Seasonal snowfall ranged from 5.6 inches during 1900–1901 to 71.8 inches during 1916–17. The greatest snowfall in one day was 24 inches on March 10, 1956. The greatest monthly snowfall was 41.8 inches during February 1915. Strong winds that often accompany snow cause large drifts in and near sheltered areas, though open fields may be nearly bare of snow.

Although records on sunshine, wind, and relative humidity are not kept at Mitchell, records kept at Sioux Falls and Huron can be used to estimate conditions in Davison County. The sun shines about two-thirds of the total time possible during an average growing season. The greatest amount of sunshine is received in July, when the sun shines approximately three-fourths of the time possible. The least occurs in December when there is less than one-half of the possible amount.

Wind speed averages about 11 miles per hour in summer, and the prevailing direction is from the south. During winter the wind averages about 12 miles per hour, and the prevailing direction is from the northeast. A wind speed of 50 miles per hour or more may occur any month but is more likely to occur in summer in association with thunderstorms. Thunderstorms occur on an average of about 10 days per month in June and July, 8 in August, 7 in May, and 5 in September. Fewer thunderstorms occur in other months, and the annual average is about 45.

Hail occasionally accompanies the thunderstorms, and it can be expected in Mitchell about once a year. Hail is more likely to fall in June.

The relative humidity in Davison County usually varies greatly from early morning to afternoon, and occasionally from day to day. The annual average is about 85 percent in early morning and 60 percent in afternoon.

The potential water loss from soil and crops is indicated by the loss from an evaporation pan. The average annual evaporation from the Weather Bureau class A pan in this county is about 51 inches. An average of about 40 inches evaporates during May through October. The evaporation from small lakes is about 37 inches; and the water loss from soil and crops generally is less, depending upon the available soil moisture.

Farming

Livestock farming is the main farm enterprise in Davison County. About 80 percent of the agriculture income is from the marketing of livestock and livestock products. From 1900 to 1935 the number of farms increased, and the average size of farms decreased. Since 1935 the number of farms has decreased, and the average size of farms has increased. In 1964, according to the U.S. Census of Agriculture, there were 678 farms. The average farm size was 403 acres.

Livestock on farms in 1964 included 44,000 cattle of all types, 24,400 hogs, 7,700 sheep and lambs, and 138,000 chickens. Of the cattle, 3,600 were cows and heifers kept for milk production.

The major crops in the county are corn, oats, sorghum, and alfalfa. In 1964 67,200 acres were planted to corn for

TABLE 10.—*Probabilities of specified temperatures in spring and fall*

[Data from records kept at Mitchell, South Dakota, for period 1896–1965. Table prepared by William F. Lytle, South Dakota State University]

Probability	Dates for given probability and temperature					
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower	36° F. or lower
After a specified date in spring:						
90 percent	March 9	March 15	March 25	April 4	April 16	April 29
70 percent	March 17	March 23	April 1	April 13	April 23	May 6
50 percent	March 30	April 6	April 15	April 29	May 8	May 19
30 percent	April 12	April 20	April 28	May 14	May 22	June 1
10 percent	April 19	April 27	May 5	May 22	May 29	June 7
Before a specified date in fall:						
10 percent	October 15	October 6	September 26	September 17	September 11	August 31
30 percent	October 23	October 14	October 5	September 25	September 18	September 7
50 percent	November 6	October 29	October 20	October 9	September 30	September 20
70 percent	November 20	November 11	November 4	October 23	October 12	October 3
90 percent	November 28	November 19	November 13	October 31	October 19	October 9

TABLE 11.—*Temperature and precipitation*

[Data from records kept at Mitchell, South Dakota, 1896–1965. Table prepared by William F. Lytle, South Dakota State University]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: 2 years in 10 will have—Average maximum temperature equal to or higher than—	Temperature: 2 years in 10 will have—Average minimum temperature equal to or lower than—	Precipitation: Average total	Precipitation: Maximum total	Precipitation: Minimum total	Precipitation: 1 year in 10 will have—Less than—	Precipitation: 1 year in 10 will have—More than—	Precipitation: Average total snowfall	Precipitation: Average number of days with—Snowfall of 1 inch or more	Precipitation: Average number of days with—Depth of snow cover 1 inch or more
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Inches	Inches	Inches		
January	27.4	6.2	37.3	−2.1	0.47	0.	2.10	0.05	1.15	5	1	10
February	30.9	9.4	40.6	.7	.64	2.92	1.49	.22	1.40	8	2	8
March	43.5	21.4	52.6	14.7	1.26	3.45	.03	.29	2.47	8	2	5
April	60.6	34.9	67.1	30.3	2.38	7.34	.05	1.76	4.33	2	0	0
May	72.1	46.2	78.2	41.7	3.18	10.58	.11	.92	5.80	0	0	0
June	81.0	56.0	86.8	52.0	3.91	8.56	.49	1.64	6.48	0	0	0
July	88.0	61.1	93.7	57.2	2.94	8.84	.24	1.03	5.31	0	0	0
August	86.1	58.9	91.0	54.7	2.69	8.49	.22	1.02	4.65	0	0	0
September	76.6	49.2	82.4	44.6	2.22	6.72	.03	.69	4.30	0	0	0
October	64.7	37.6	71.5	32.9	1.47	4.82	0	.33	3.19	1	0	0
November	45.8	23.5	53.3	18.2	.70	2.71	0	.12	1.69	3	1	2
December	31.9	11.9	39.8	4.5	.49	2.13	0	.07	1.10	5	1	7
Year	59.1	34.7	61.0	32.9	22.35	[1] 33.57	[2] 11.60	16.36	26.91	32	7	32

[1] In 1944. [2] In 1925.

all purposes, of which 36,100 were harvested for grain; oats for grain was harvested from 43,000 acres; 12,200 acres were planted to sorghums for all purposes, of which 8,300 acres were harvested for grain; and 21,400 acres of alfalfa were harvested for hay. Small acreages were in spring wheat, durum wheat, barley, rye, and soybeans. Spring wheat, barley, and rye were major crops until about 1950. Since 1950 the acreage planted to those crops has declined, and acreages in tame grass, alfalfa, and sorghums for grain or for forage have increased. Crop production in Davison County is geared mainly to provide a feed base for livestock.

Information about the history of crop production and livestock numbers in Davison County can be obtained from the annual reports of the South Dakota Crop and Livestock Reporting Service (*5*).

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Buried soil. A developed soil, once exposed but now overlain by more recently formed soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: Clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Gravel. Rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

Habitat. The natural abode of a plant or animal; it refers to the kind of environment in which a plant or animal normally lives as opposed to its range, or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consist of decaying plant residue.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material. The disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity. See also Reaction, soil.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips, or bands, to serve as vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

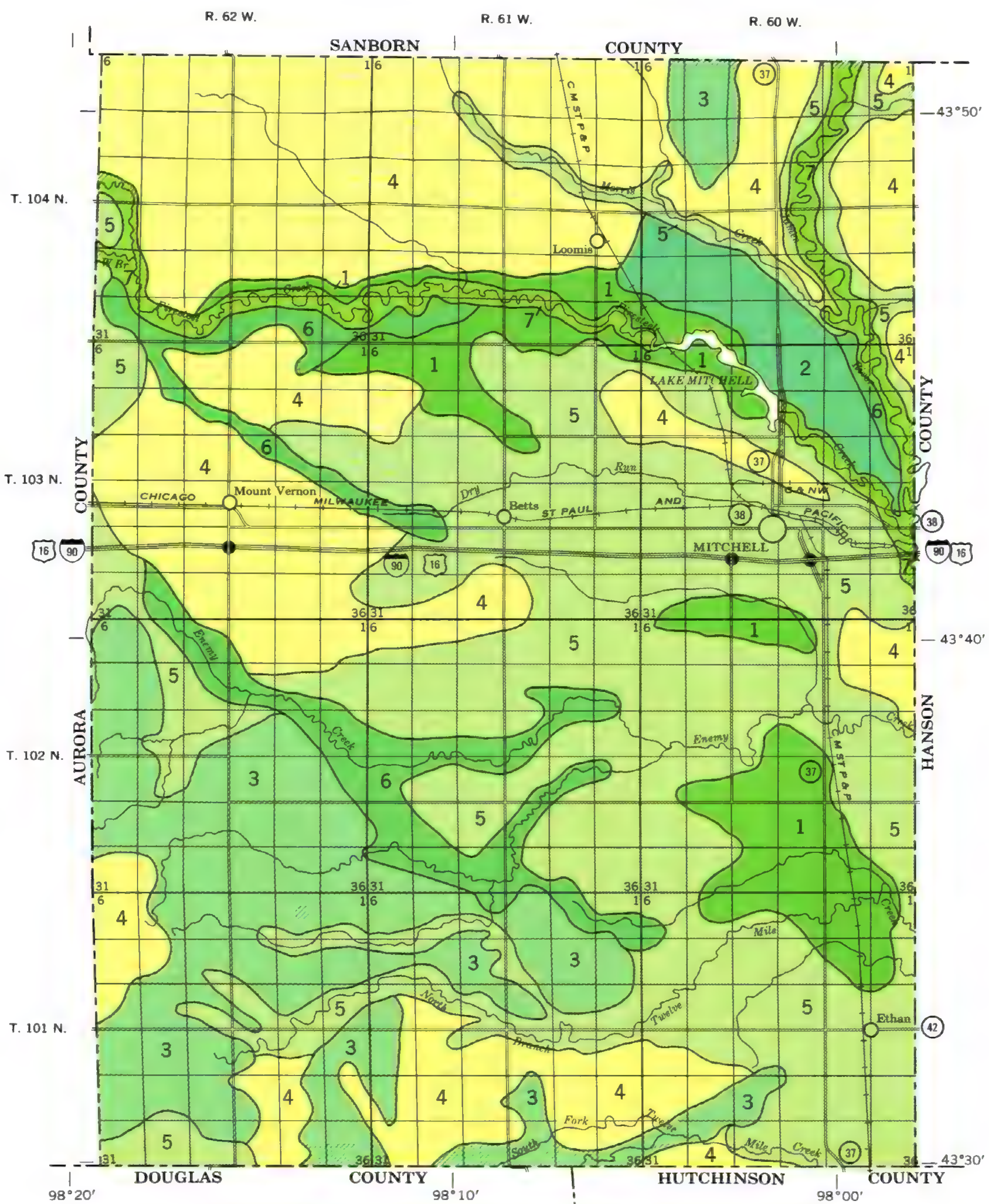
GENERAL SOIL MAP

DAVISON COUNTY, SOUTH DAKOTA

Scale 1:190080

1 0 1 2 3 4 Miles

N



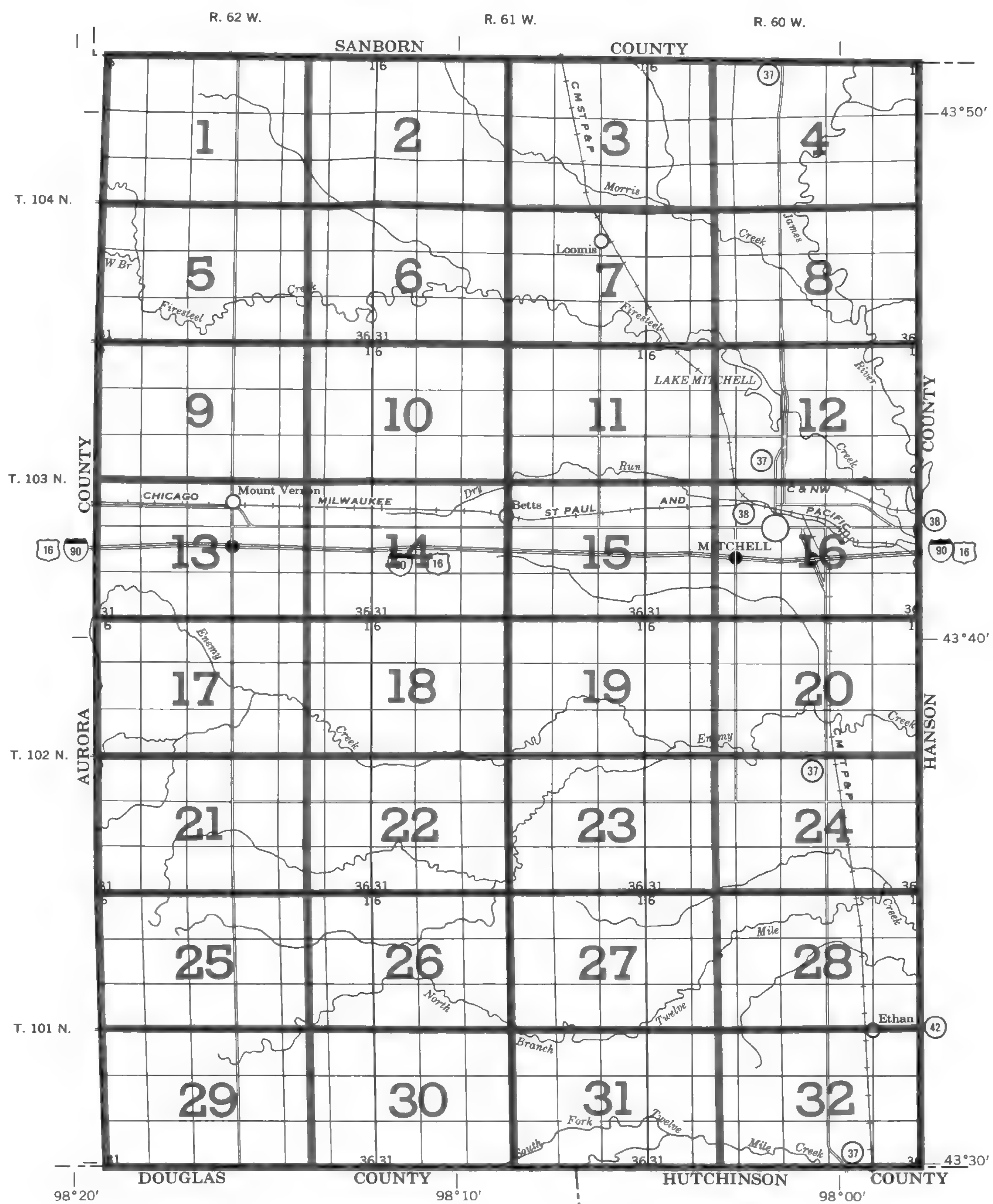
SOIL ASSOCIATIONS*

1	Enet-Delmont association: Nearly level to gently undulating, well-drained to somewhat excessively drained, loamy soils that formed in alluvium over sand and gravel on terraces and uplands
2	Blendon-Hand association: Nearly level to gently undulating, well-drained, loamy soils that formed in sandy and loamy glacial outwash on uplands
3	Houdek-Stickney association: Nearly level, well drained and moderately well drained, loamy soils that formed in glacial till on uplands
4	Houdek-Prosper-Tetonka association: Nearly level, well drained and moderately well drained, loamy soils that formed in glacial till and somewhat poorly drained silty soils on uplands
5	Clarno-Houdek-Betts association: Nearly level to steep, well-drained to excessively drained, loamy soils that formed in glacial till on uplands
6	Redstoe-Firesteel association: Nearly level to hilly, well-drained to somewhat poorly drained, calcareous, loamy and silty soils over siltstone on uplands
7	Clamo-Lamo-Bon association: Nearly level, moderately well drained to poorly drained, silty and loamy soils that formed in alluvium on bottom lands

*Texture refers to the surface layer soils in each association.

Published 1972

This map is for general planning. It shows only the major soils and does not contain sufficient detail for operational planning.



INDEX TO MAP SHEETS

DAVISON COUNTY, SOUTH DAKOTA

Scale 1:190 080

1 0 1 2 3 4 Miles

N

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Most symbols without a slope letter are those for soils or land types that are nearly level, but some are for soils or land types that have a considerable range of slope. The number, 2, in the symbol indicates that the soil is eroded.

SYMBOL	NAME
Aa	Alluvial land
BaA	Beadle loam, 0 to 2 percent slopes
BeE	Betts and Ethan loams, 21 to 40 percent slopes
BhD	Betts-Ethan loams, 6 to 21 percent slopes
BlE	Betts-Gavins complex, 15 to 40 percent slopes
BmA	Blendon sandy loam, 0 to 3 percent slopes
BnA	Blendon-Firesteel complex, 0 to 3 percent slopes
BoA	Bon loam, 0 to 2 percent slopes
Ca	Clamo silty clay loam
Cc	Clamo silty clay loam, frequently flooded
CeB	Clarno-Ethan loams, 3 to 6 percent slopes
CeC	Clarno-Ethan loams, 6 to 9 percent slopes
ChA	Clarno-Houdek loams, 0 to 3 percent slopes
ChB	Clarno-Houdek loams, 3 to 6 percent slopes
DhA	Davison-Hand loams, 0 to 2 percent slopes
DmB	Delmont loam, 3 to 6 percent slopes
EnA	Enet loam, 0 to 3 percent slopes
EoA	Enet-Delmont loams, 0 to 3 percent slopes
EoB	Enet-Delmont loams, 3 to 6 percent slopes
EsA	Enet-Storla loams, 0 to 2 percent slopes
EtC2	Ethan-Betts loams, 5 to 9 percent slopes, eroded
FeA	Fedora sandy loam, 0 to 3 percent slopes
FsA	Firesteel silt loam, 0 to 2 percent slopes
HaB	Hand loam, 3 to 6 percent slopes
HdA	Hand-Davison loams, 0 to 3 percent slopes
HkA	Houdek-Prosper loams, 0 to 2 percent slopes
HpA	Houdek, Prosper and Stickney loams, 0 to 1 percent slopes
HsA	Houdek-Stickney loams, 0 to 2 percent slopes
La	Lamo silt loam
LpA	Lamo and Prosper soils, 0 to 3 percent slopes
PrA	Prosper silt loam, 0 to 3 percent slopes
PrB	Prosper silt loam, 3 to 6 percent slopes
ReA	Redstoe loam, 0 to 3 percent slopes
ReC	Redstoe loam, 3 to 9 percent slopes
ReD	Redstoe loam, 9 to 21 percent slopes
Sa	Salmo silt loam
SdA	Stickney-Dudley complex, 0 to 2 percent slopes
SoA	Storla loam, 0 to 2 percent slopes
StA	Storla complex, 0 to 2 percent slopes
TeA	Tetonka silt loam, 0 to 2 percent slopes
TsA	Tetonka-Stickney complex, 0 to 3 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

- Highways and roads
  - Dual
  - Good motor
  - Poor motor
  - Trail
- Highway markers
  - National Interstate
  - U. S.
  - State or county
- Railroads
  - Single track
  - Multiple track
  - Abandoned
- Bridges and crossings
  - Road
  - Trail
  - Railroad
  - Ferry (FY)
  - Ford (FORD)
  - Grade
  - R. R. over
  - R. R. under
- Tunnel
- Buildings
  - School
  - Church
- Mine and quarry
- Gravel pit (G.P.)
- Power line
- Pipeline
- Cemetery
- Dams
- Levee
- Tanks
- Well, oil or gas
- Forest fire or lookout station
- Windmill

BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

- Streams, double-line
  - Perennial
  - Intermittent
- Streams, single-line
  - Perennial
  - Intermittent
    - Crossable with tillage implements
    - Not crossable with tillage implements
  - Unclassified
- Canals and ditches (CANAL)
- Lakes and ponds
  - Perennial (water, w)
  - Intermittent (int)
- Spring
- Marsh or swamp
- Wet spot
- Alluvial fan
- Drainage end

RELIEF

- Escarpments
  - Bedrock
  - Other
- Prominent peak
- Depressions (Large, Small)
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony, Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the series to which it belongs. A technical description of a profile that is representative of the series is part of each series description. Complete information about soil capability units is in the subsection "Management by Capability Units," pages 32 to 36. Facts about managing the soils for pasture are given on pages 38 to 39. Other information is in tables as follows:

Acreage and extent, table 1, page 7.
Predicted yields, table 2, page 37.
Windbreak suitability groups, table 3, page 42.
Wildlife potentials, table 4, page 44.
Engineering uses of soils, tables 5, 6, 7, and 8, pages 46 to 61.

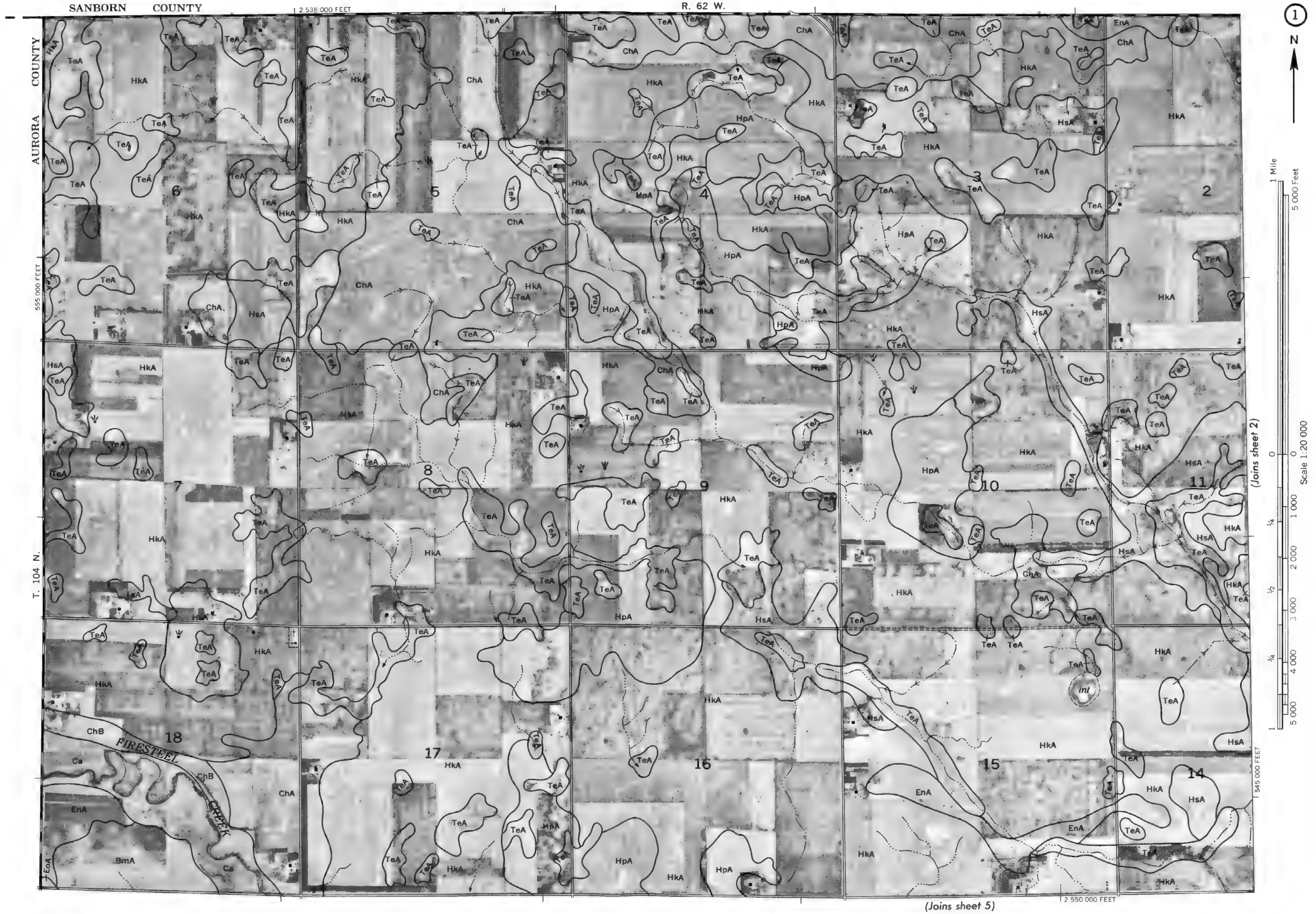
Map symbol	Mapping unit	Described on page	Capability unit		Pasture group		Windbreak group	
			Symbol	Page	Symbol	Page	Number	Page
Aa	Alluvial land	7	VIw-1	36	B	38	2	41
BaA	Beadle loam, 0 to 2 percent slopes	8	IIs-1	33	E	38	4	41
BeE	Betts and Ethan loams, 21 to 40 percent slopes	8	VIIe-1	36	---	--	10	42
BhD	Betts-Ethan loams, 6 to 21 percent slopes	9						
	Betts part	--	VIe-1	36	G	39	10	42
	Ethan part	--	VIe-1	36	F	39	10	42
BlE	Betts-Gavins complex, 15 to 40 percent slopes	9	VIIe-1	36	--	--	10	42
BmA	Blendon sandy loam, 0 to 3 percent slopes	10	IIIe-3	34	H	39	5	41
BnA	Blendon-Firesteel complex, 0 to 3 percent slopes	10						
	Blendon part	--	IIIe-3	34	H	39	5	41
	Firesteel part	--	IIIs-3	34	F	39	2	41
BoA	Bon loam, 0 to 2 percent slopes	11	IIc-1	33	K	39	1	40
Ca	Clamo silty clay loam	12	IIw-1	32	A (drained), B (undrained)	38 38	2	41
Cc	Clamo silty clay loam, frequently flooded	12	Vw-1	36	B	38	2	41
CeB	Clarno-Ethan loams, 3 to 6 percent slopes	13	IIe-2	32	F	39	3	41
CeC	Clarno-Ethan loams, 6 to 9 percent slopes	13	IIIe-1	33	F	39	3	41
ChA	Clarno-Houdek loams, 0 to 3 percent slopes	14	IIc-2	33	F	39	3	41
ChB	Clarno-Houdek loams, 3 to 6 percent slopes	14	IIe-2	32	F	39	3	41
DhA	Davison-Hand loams, 0 to 2 percent slopes	14						
	Davison part	--	IIe-1	32	K	39	1	40
	Hand part	--	IIe-1	32	F	39	3	41
DmB	Delmont loam, 3 to 6 percent slopes	15	IVe-1	35	D	38	10	42
EnA	Enet loam, 0 to 3 percent slopes	16	IIIs-2	34	D	38	6	41
EoA	Enet-Delmont loams, 0 to 3 percent slopes	17						
	Enet part	--	IIIs-2	34	D	38	6	41
	Delmont part	--	IVs-2	35	D	38	10	42
EoB	Enet-Delmont loams, 3 to 6 percent slopes	17	IIIe-2	33	D	38	6	41
	Enet part	--	IIIe-2	33	D	38	6	41
	Delmont part	--	IVe-1	35	D	38	10	42
EsA	Enet-Storla loams, 0 to 2 percent slopes	17						
	Enet part	--	IIIs-2	34	D	38	6	41
	Storla part	--	IIIs-2	34	A	38	2	41
EtC2	Ethan-Betts loams, 5 to 9 percent slopes, eroded	18	VIe-1	36	G	39	10	42
FeA	Fedora sandy loam, 0 to 3 percent slopes	19	IIIw-1	34	A	38	2	41
FsA	Firesteel silt loam, 0 to 2 percent slopes	19	IIIs-3	34	F	39	2	41
HaB	Hand loam, 3 to 6 percent slopes	21	IIe-2	32	F	39	3	41
HdA	Hand-Davison loams, 0 to 3 percent slopes	21						
	Hand part	--	IIc-2	33	F	39	3	41
	Davison part	--	IIc-2	33	K	39	1	40
HkA	Houdek-Prosper loams, 0 to 2 percent slopes	22						
	Houdek part	--	IIc-2	33	F	39	3	41
	Prosper part	--	IIc-2	33	K	39	1	40
HpA	Houdek, Prosper and Stickney loams, 0 to 1 percent slopes	22						
	Houdek part	--	IIc-2	33	F	39	3	41
	Prosper part	--	IIc-1	33	K	39	1	40
	Stickney part	--	IIIs-1	34	E	38	4	41
HsA	Houdek-Stickney loams, 0 to 2 percent slopes	23						
	Houdek part	--	IIc-2	33	F	39	3	41
	Stickney part	--	IIIs-1	34	E	38	4	41
La	Lamo silt loam	23	IIw-1	32	A (drained), B (undrained)	38 38	2	41
LpA	Lamo and Prosper soils, 0 to 3 percent slopes	24						
	Lamo part	--	IIw-1	32	A (drained), B (undrained)	38 38	2	41
	Prosper part	--	IIc-1	33	K	39	1	40
PrA	Prosper silt loam, 0 to 3 percent slopes	25	IIc-1	33	K	39	1	40
PrB	Prosper silt loam, 3 to 6 percent slopes	25	IIe-3	32	K	39	1	40
ReA	Restoe loam, 0 to 3 percent slopes	26	IVs-3	36	G	39	8	41
ReC	Redstoe loam, 3 to 9 percent slopes	26	IVe-2	35	G	39	8	41
ReD	Redstoe loam, 9 to 21 percent slopes	26	VIe-1	36	G	39	10	42
Sa	Salmo silt loam	27	IVw-1	35	J	39	10	42
SdA	Stickney-Dudley complex, 0 to 2 percent slopes	27						
	Stickney part	--	IIIs-1	34	E	38	4	41
	Dudley part	--	IVs-1	35	C	38	9	41
SoA	Storla loam, 0 to 2 percent slopes	28	IIIs-3	34	A	38	2	41
StA	Storla complex, 0 to 2 percent slopes	28	IIIs-3	34	A	38	2	41
TeA	Tetonka silt loam, 0 to 2 percent slopes	29	IIw-2	32	A (drained), B (undrained)	38 38	10	42
TsA	Tetonka-Stickney complex, 0 to 3 percent slopes	29						
	Tetonka part	--	IIw-2	32	A (drained), B (undrained)	38 38	10	42
	Stickney part	--	IIIs-1	34	E	38	4	41

464-394 O - 73 (Face Maps)

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the South Dakota Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.
Land division corners are approximately positioned on this map.

DAVISON COUNTY, SOUTH DAKOTA NO. 1

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 1



DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 2

DAVISON COUNTY, SOUTH DAKOTA NO. 2

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the South Dakota Agricultural Experiment Station. Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone. Land division corners are approximately positioned on this map.

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DAVISON COUNTY, SOUTH DAKOTA NO. 3

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 3

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 4

DAVISON COUNTY, SOUTH DAKOTA NO. 4

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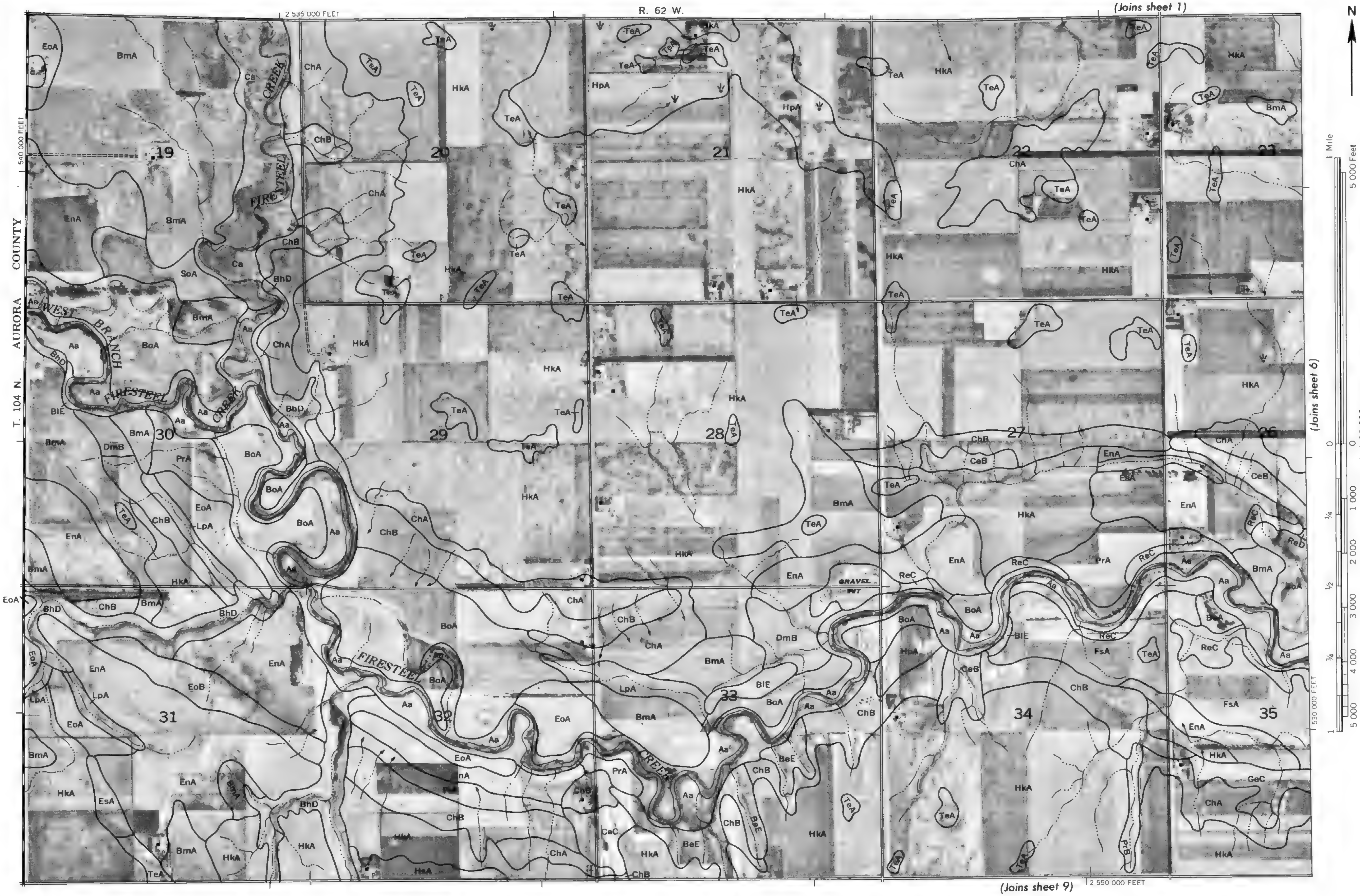
Land division corners are approximately positioned on this map



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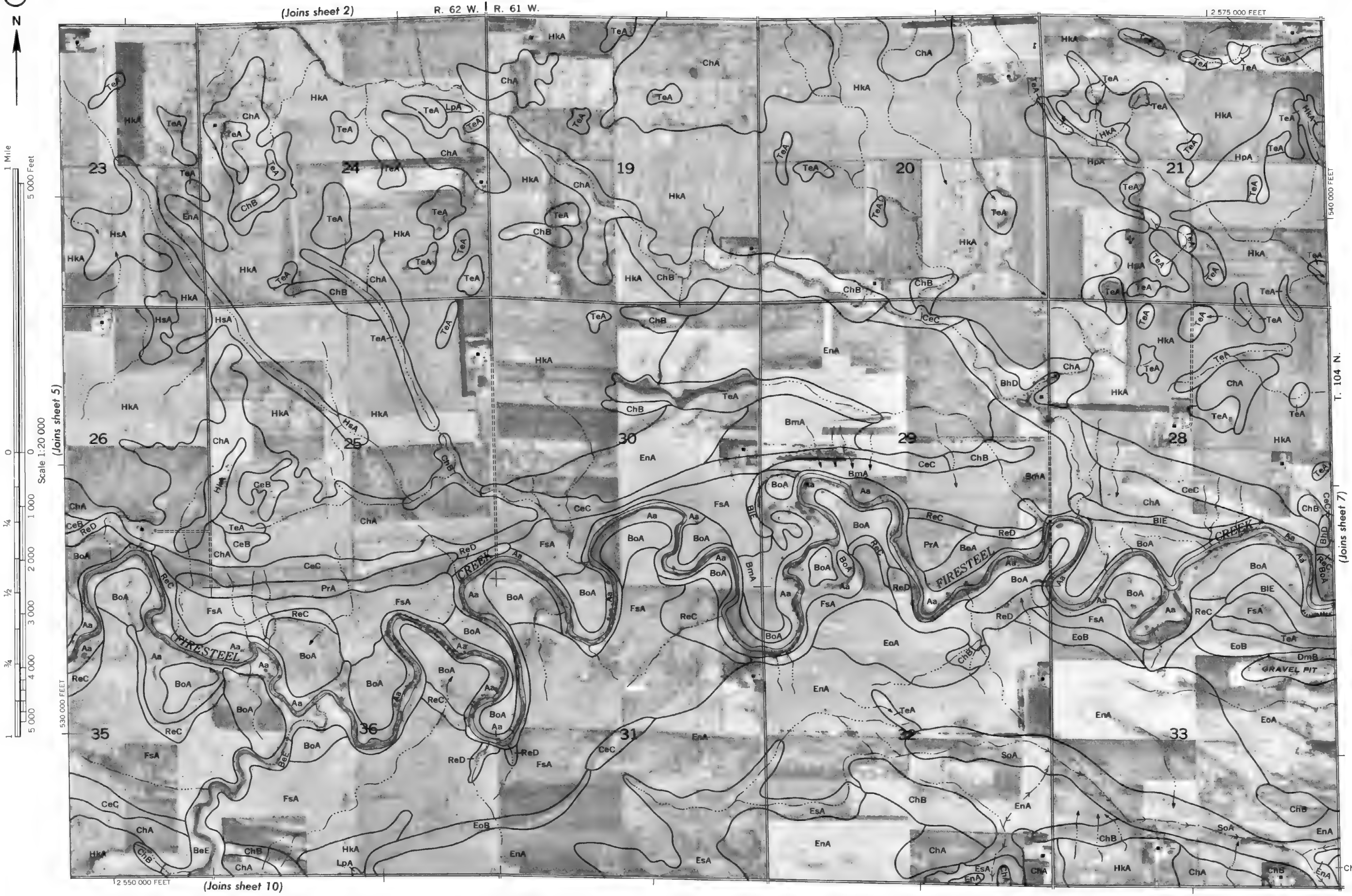
DAVISON COUNTY, SOUTH DAKOTA NO. 5



DAVISON COUNTY, SOUTH DAKOTA NO. 6

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the South Dakota Agricultural Experiment Station.
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DAVISON COUNTY, SOUTH DAKOTA NO. 7

DAVISON COUNTY, SOUTH DAKOTA NO. 8

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9

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DAVISON COUNTY, SOUTH DAKOTA NO. 9

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 10

DAVISON COUNTY, SOUTH DAKOTA NO. 10

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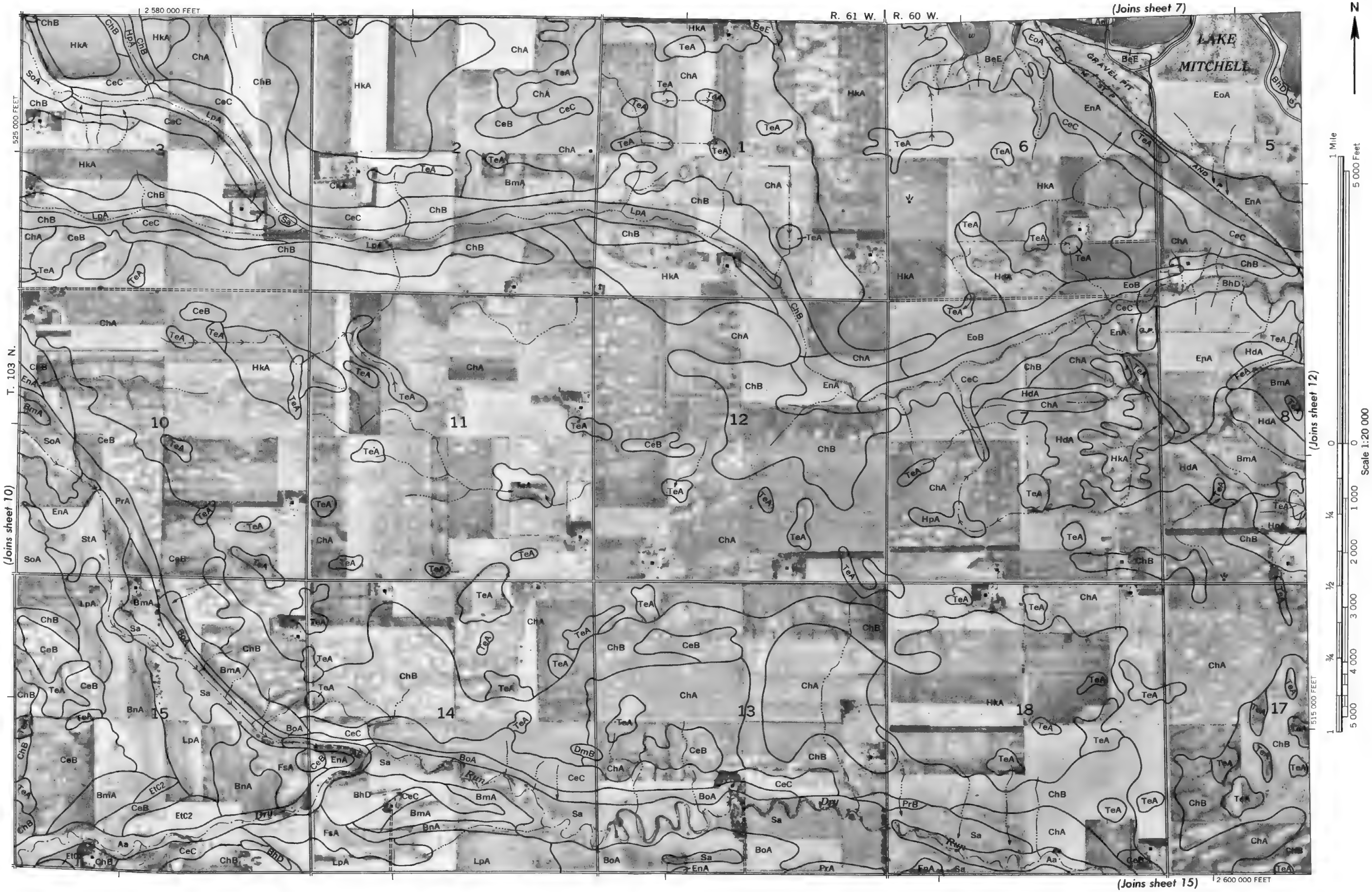
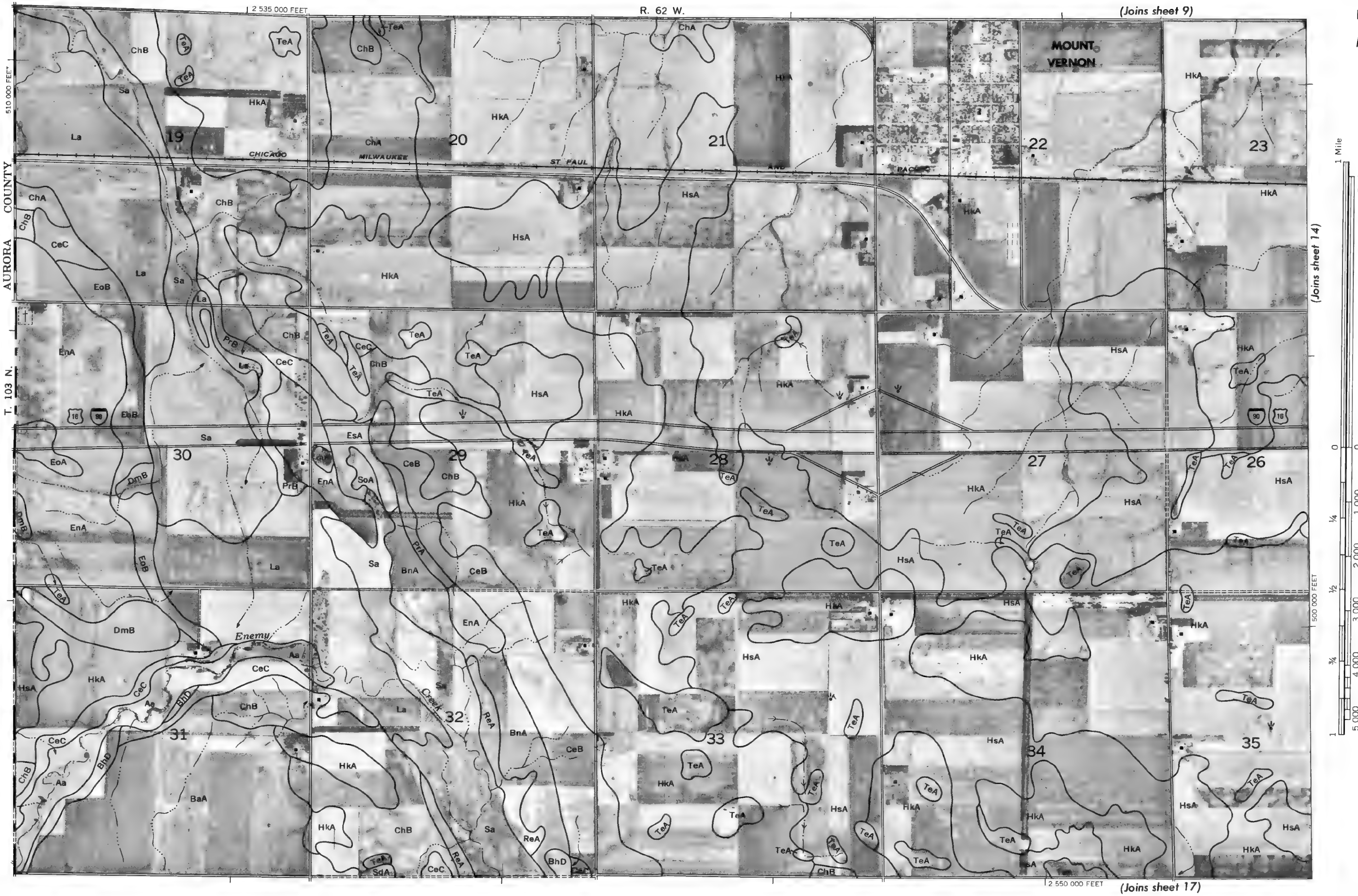
DAVISON COUNTY, SOUTH DAKOTA NO. 11



DAVISON COUNTY, SOUTH DAKOTA NO. 12

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the South Dakota Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.
Land division corners are approximately positioned on this map

13



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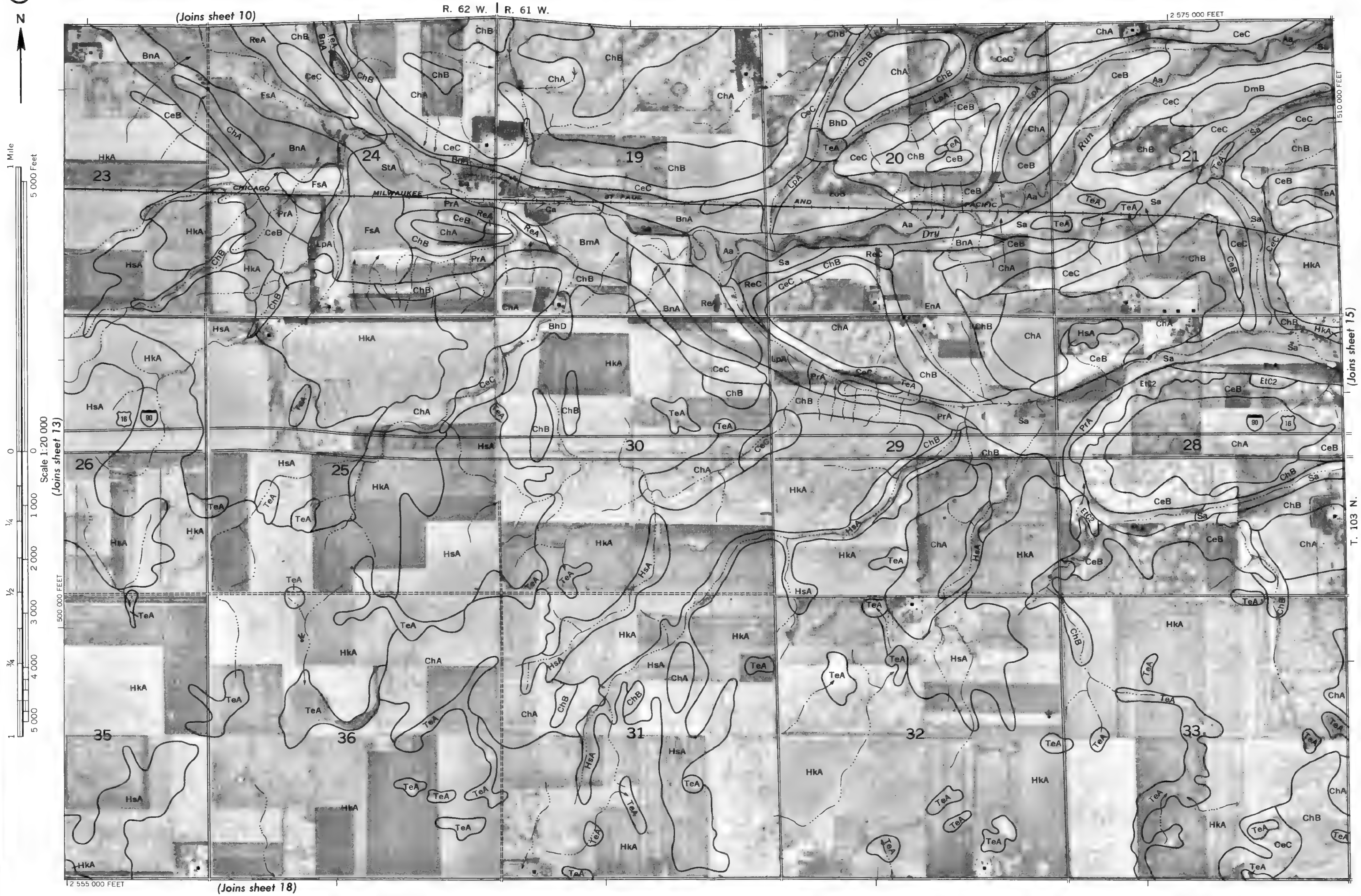
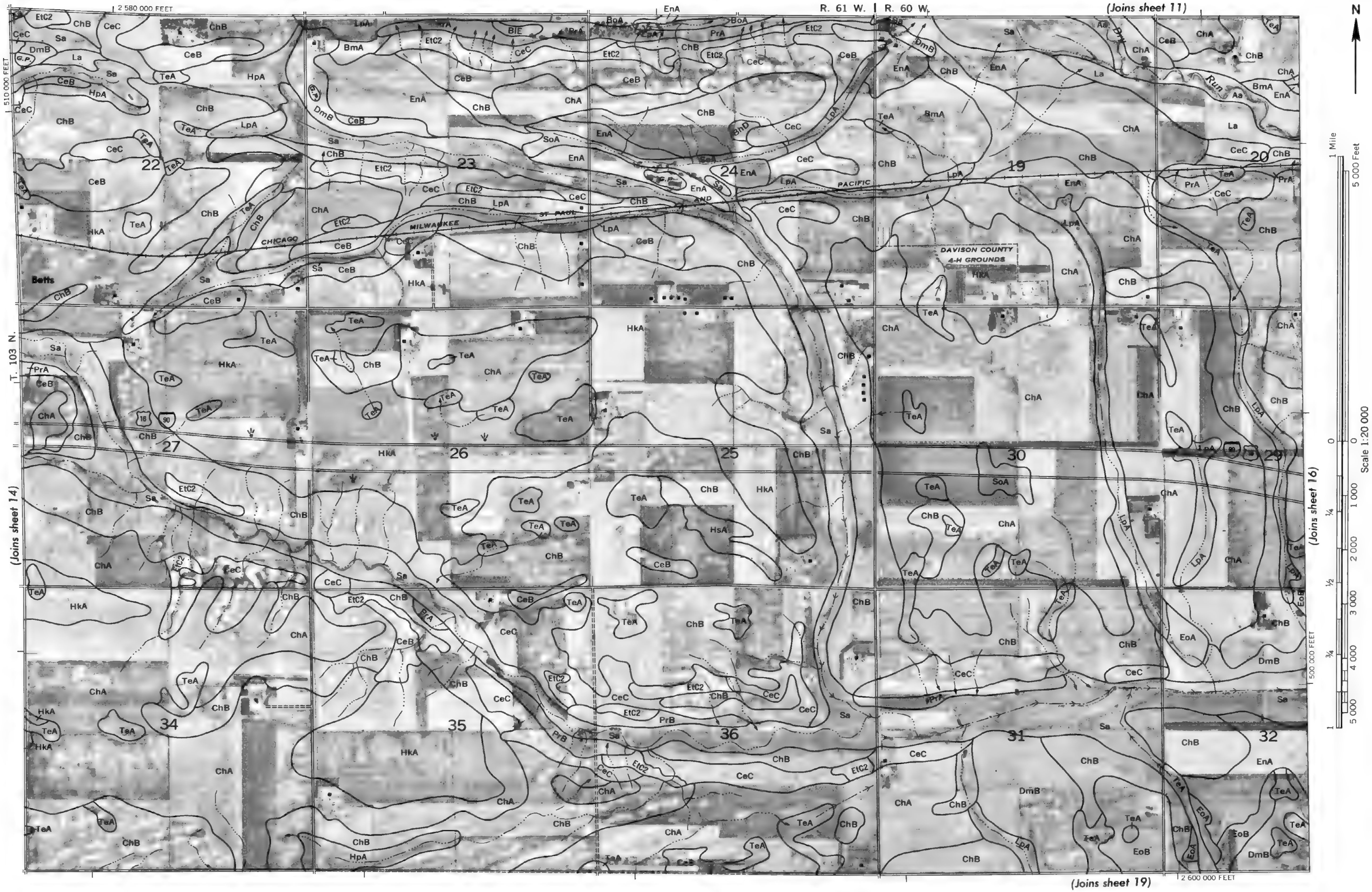
DAVISON COUNTY, SOUTH DAKOTA NO. 13

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 14



DAVISON COUNTY, SOUTH DAKOTA NO. 14

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the South Dakota Agricultural Experiment Station. Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone. Land division corners are approximately positioned on this map.



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DAVISON COUNTY, SOUTH DAKOTA NO. 15

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 16

DAVISON COUNTY, SOUTH DAKOTA NO. 16

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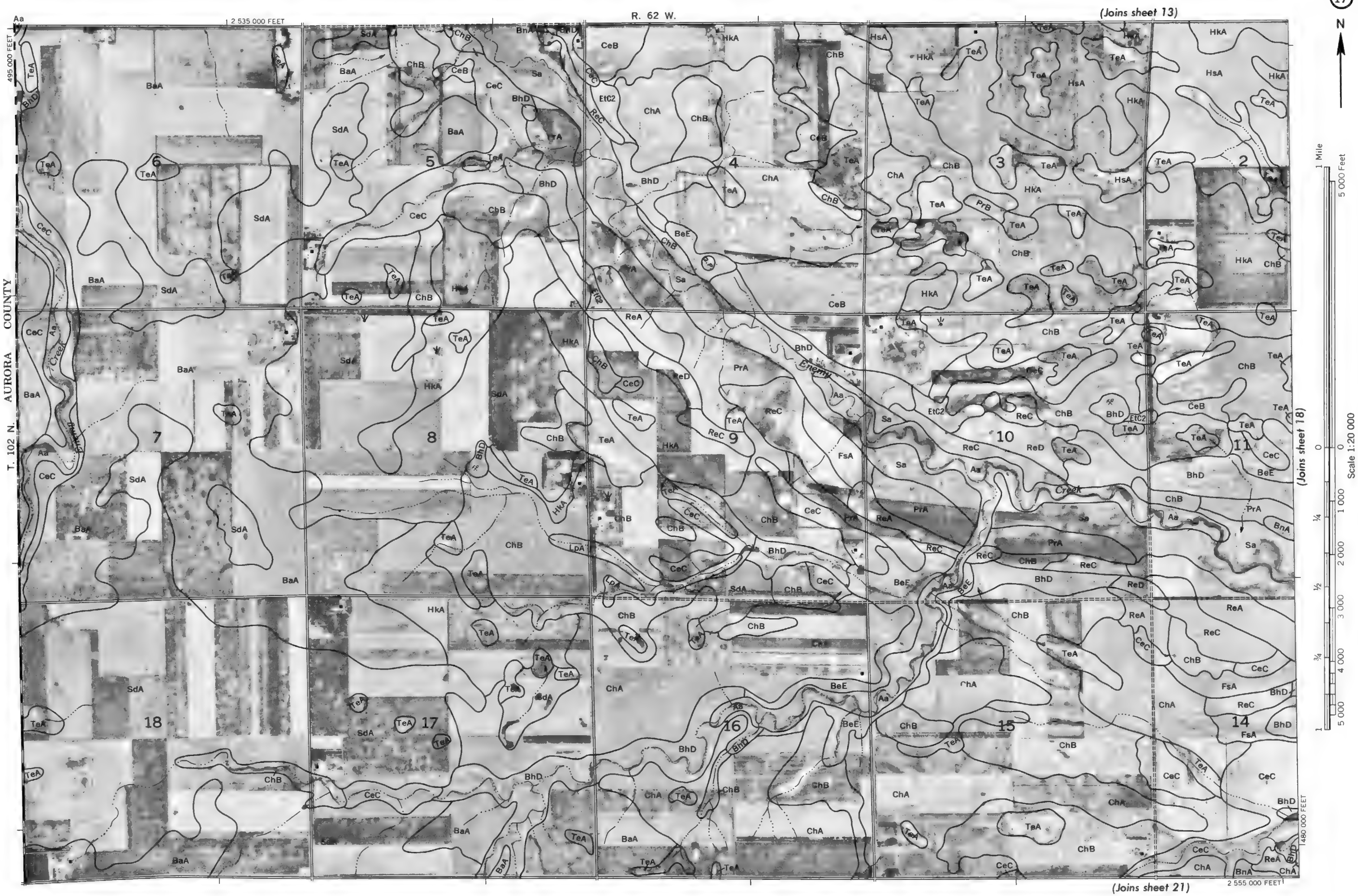
DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 17



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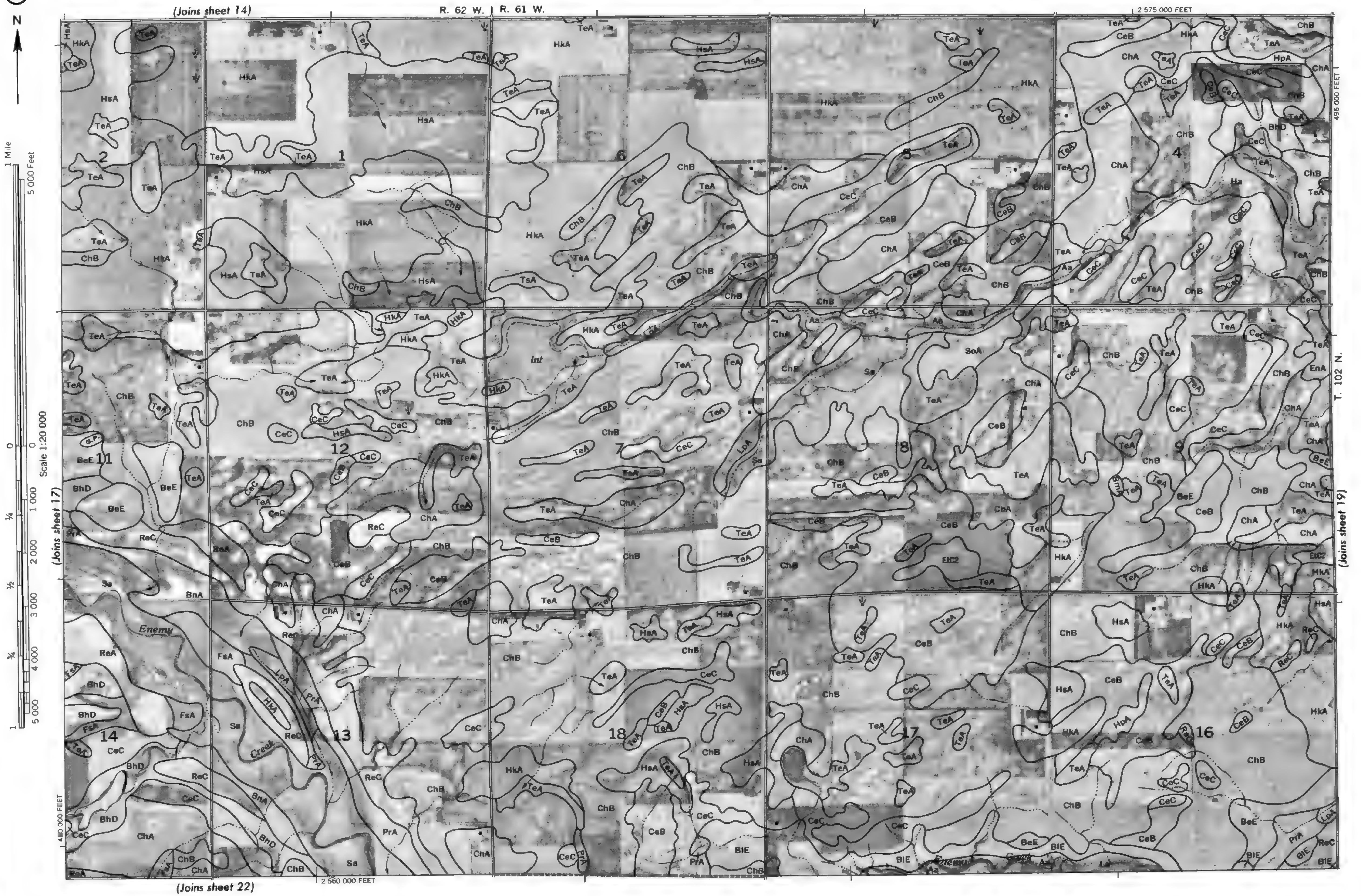
DAVISON COUNTY, SOUTH DAKOTA NO. 17



DAVISON COUNTY, SOUTH DAKOTA NO. 18

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the South Dakota Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.
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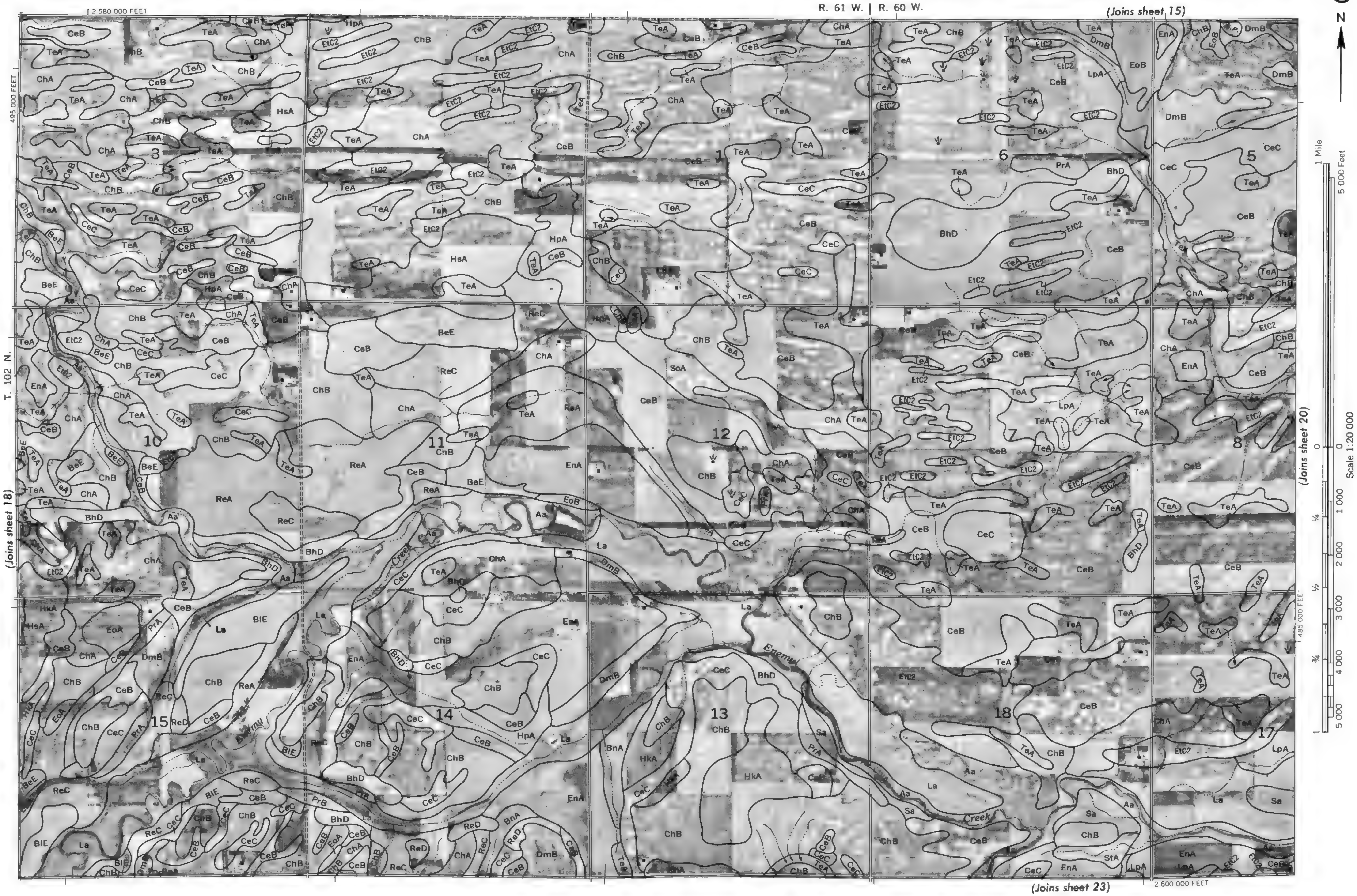
19



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DAVISON COUNTY, SOUTH DAKOTA NO. 19

DAVISON COUNTY, SOUTH DAKOTA NO. 20

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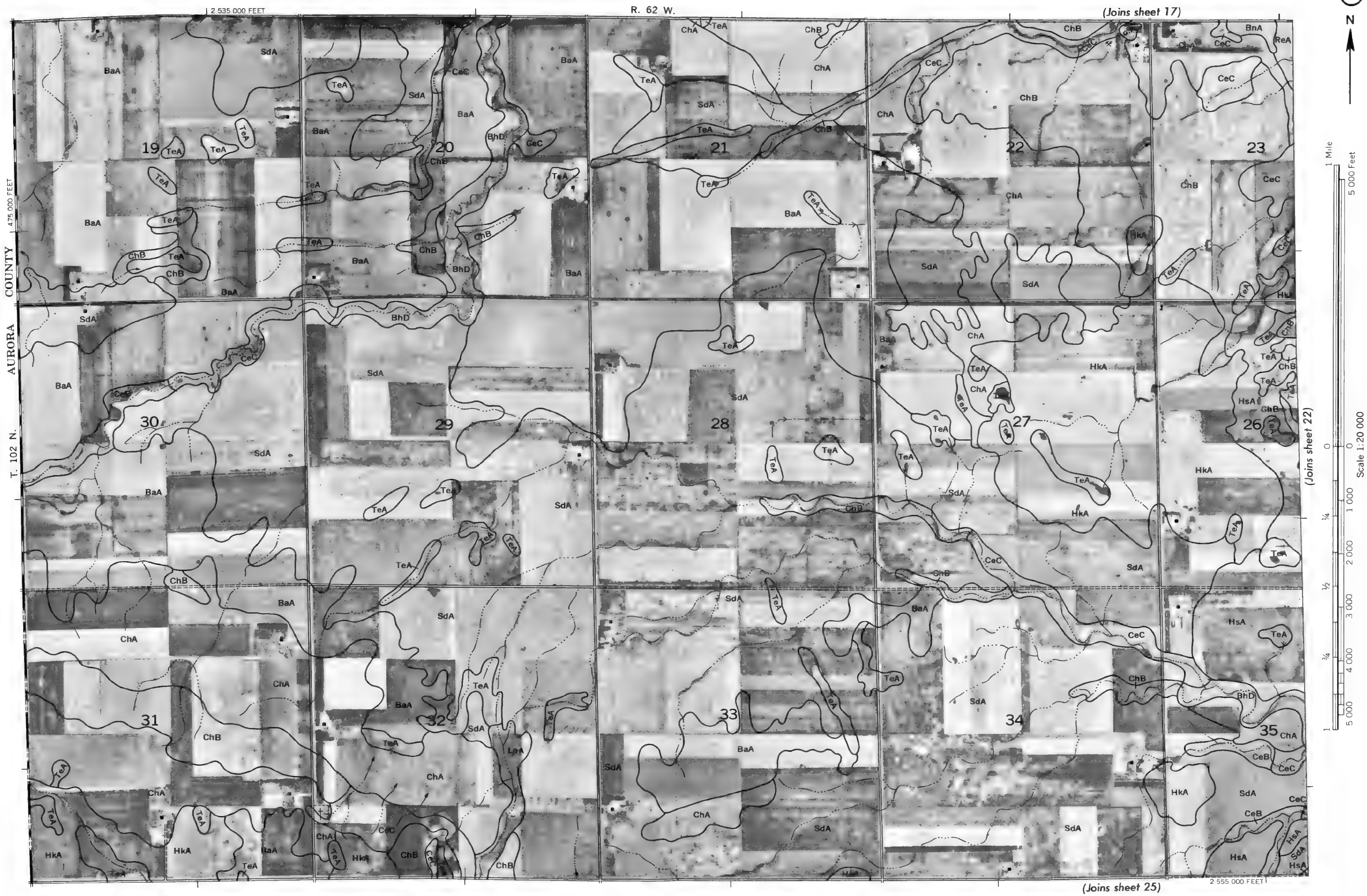
DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 21



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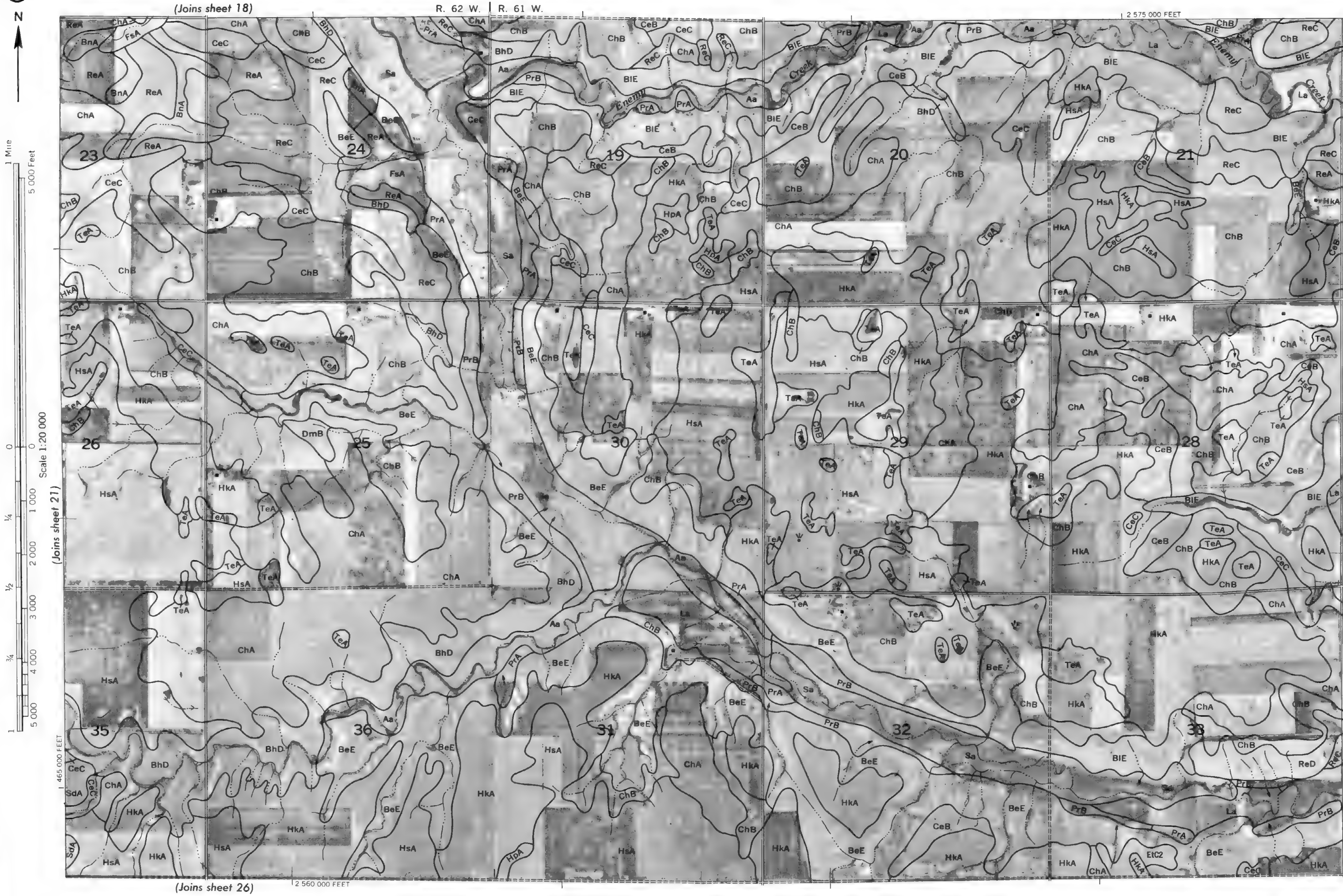
DAVISON COUNTY, SOUTH DAKOTA NO. 21

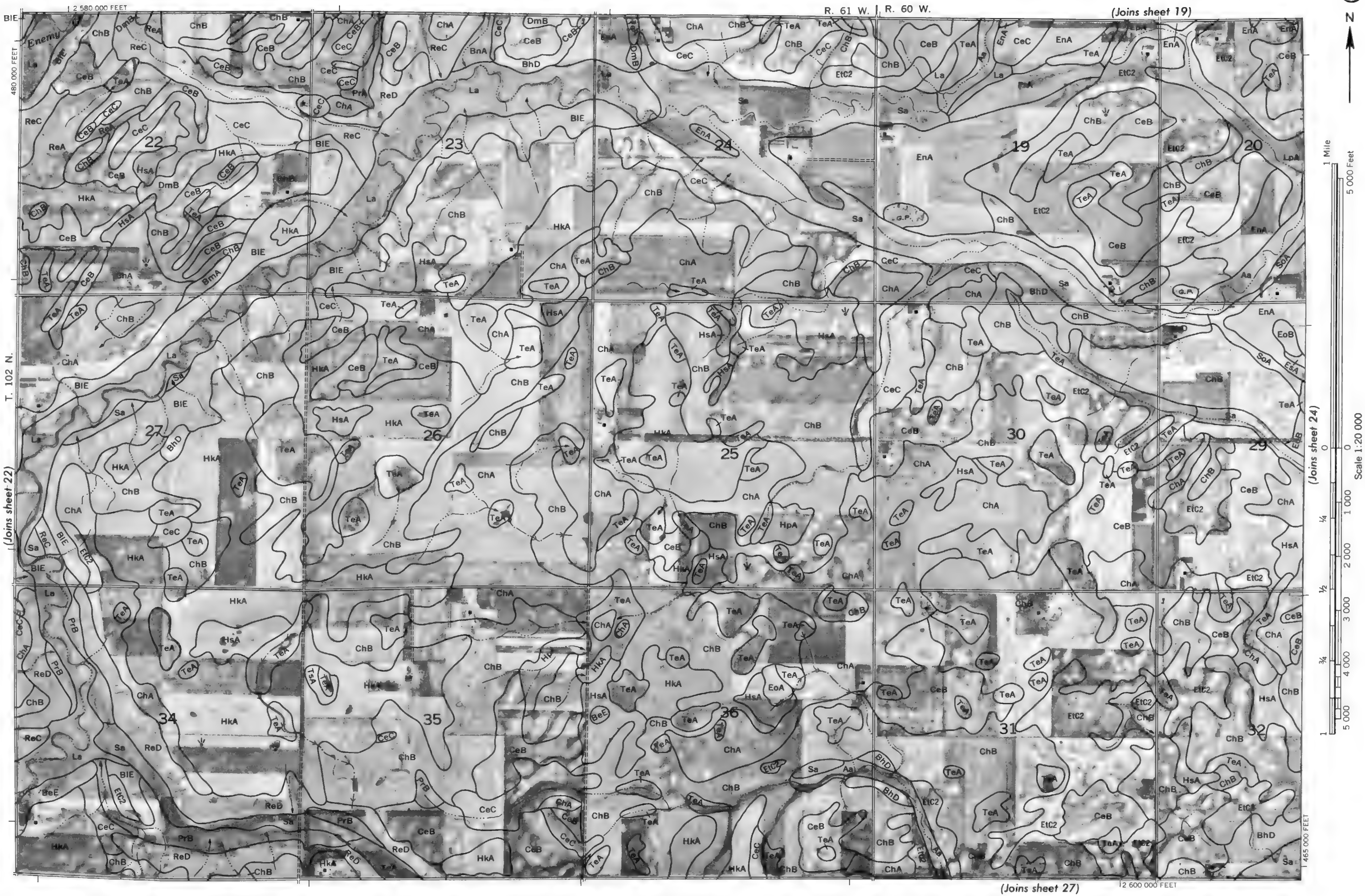
DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 22



DAVISON COUNTY, SOUTH DAKOTA NO. 22

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the South Dakota Agricultural Experiment Station. Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone. Land division corners are approximately positioned on this map.

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 23



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DAVISON COUNTY, SOUTH DAKOTA NO. 23

DAVISON COUNTY, SOUTH DAKOTA NO. 24

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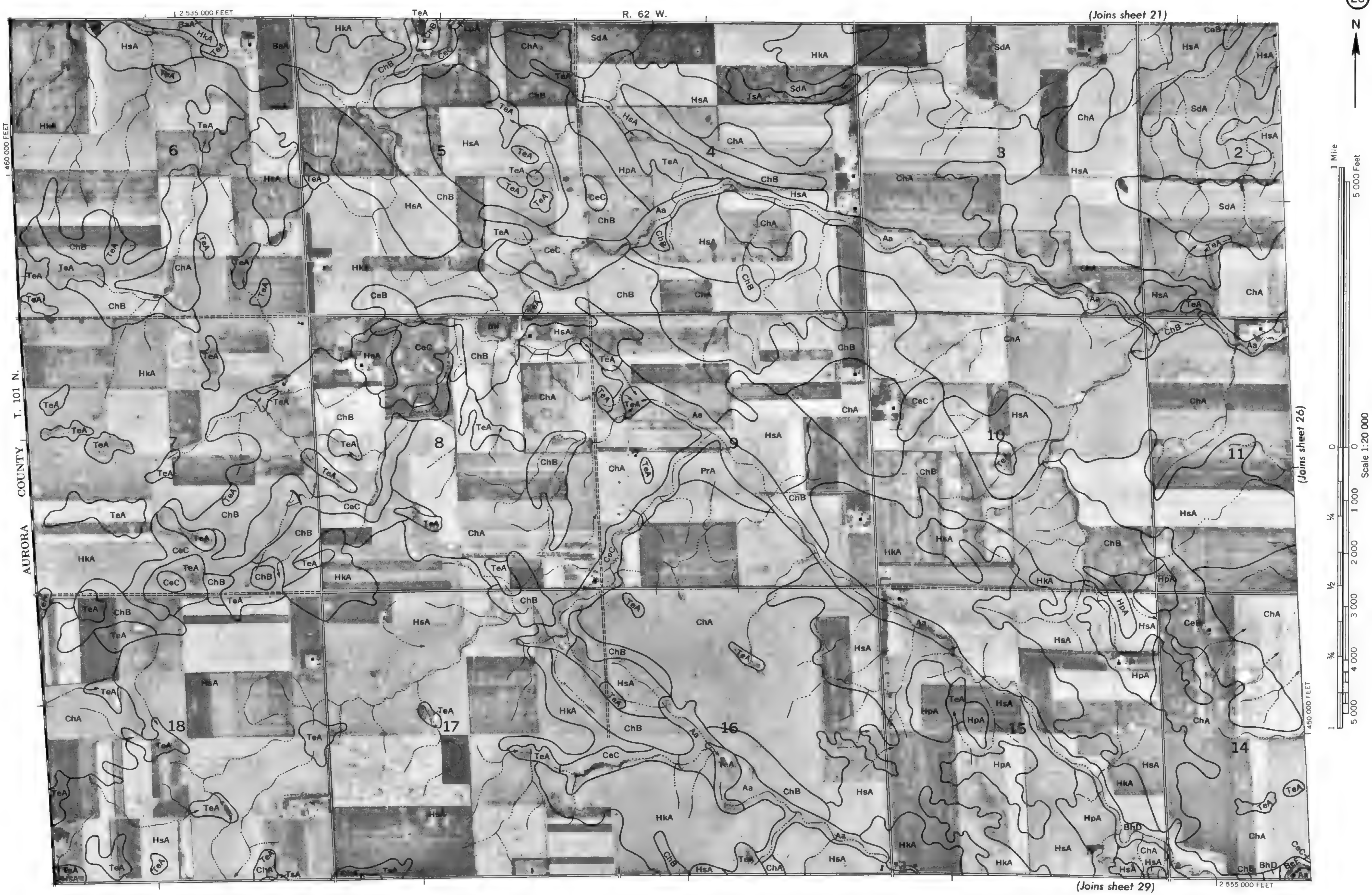

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DAVISON COUNTY, SOUTH DAKOTA NO. 25

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 26

DAVISON COUNTY, SOUTH DAKOTA NO. 26

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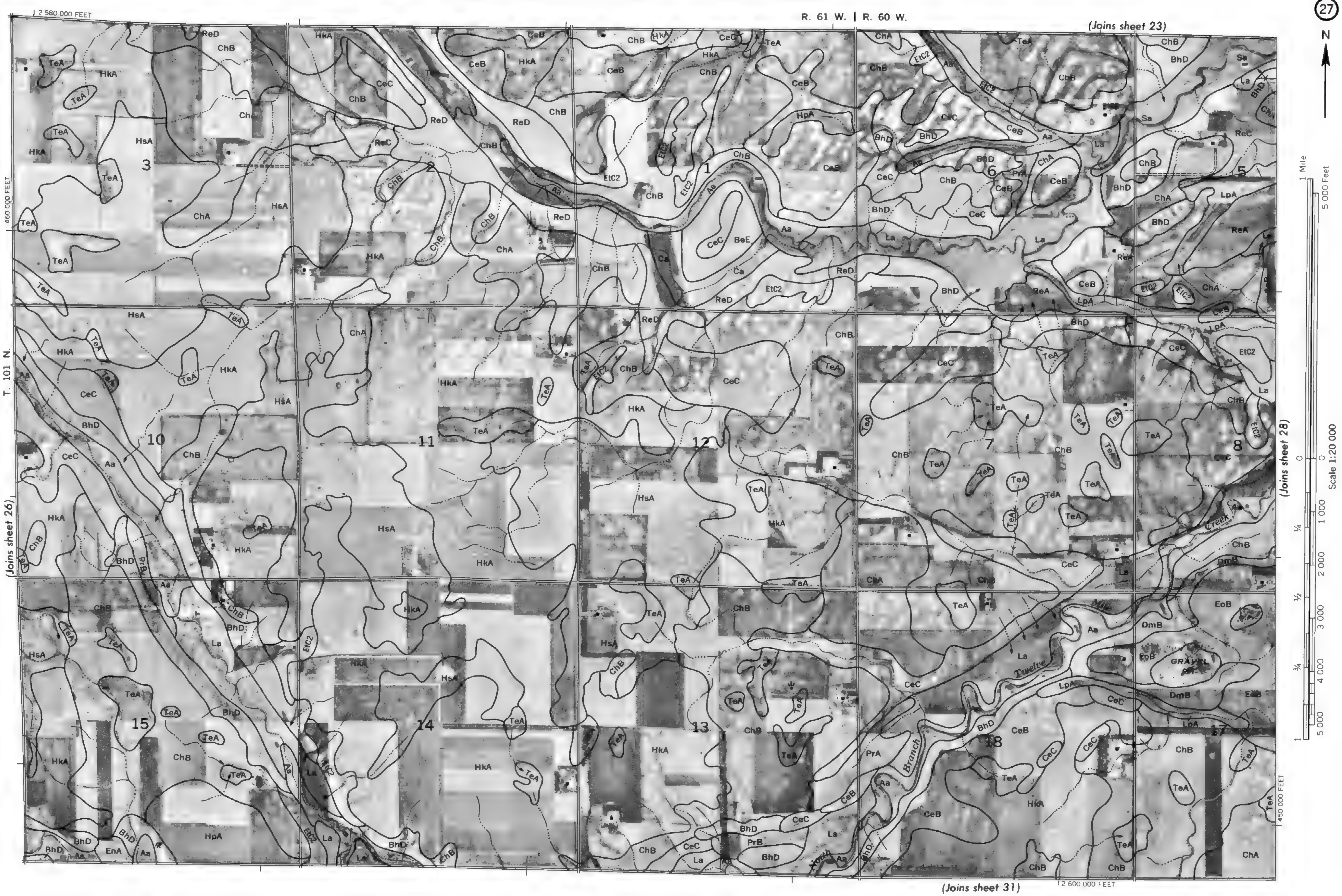

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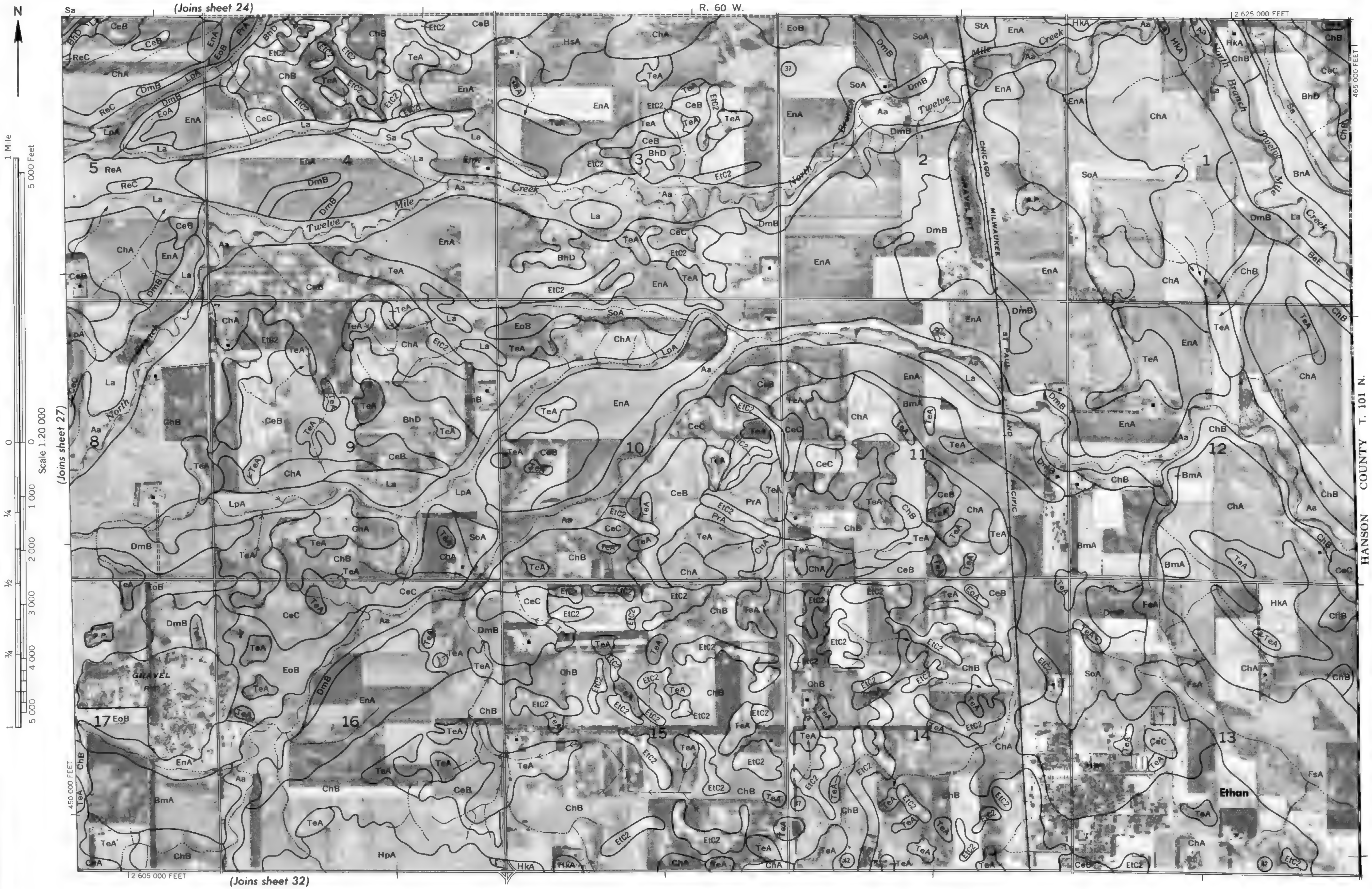
DAVISON COUNTY, SOUTH DAKOTA NO. 27



DAVISON COUNTY, SOUTH DAKOTA NO. 28

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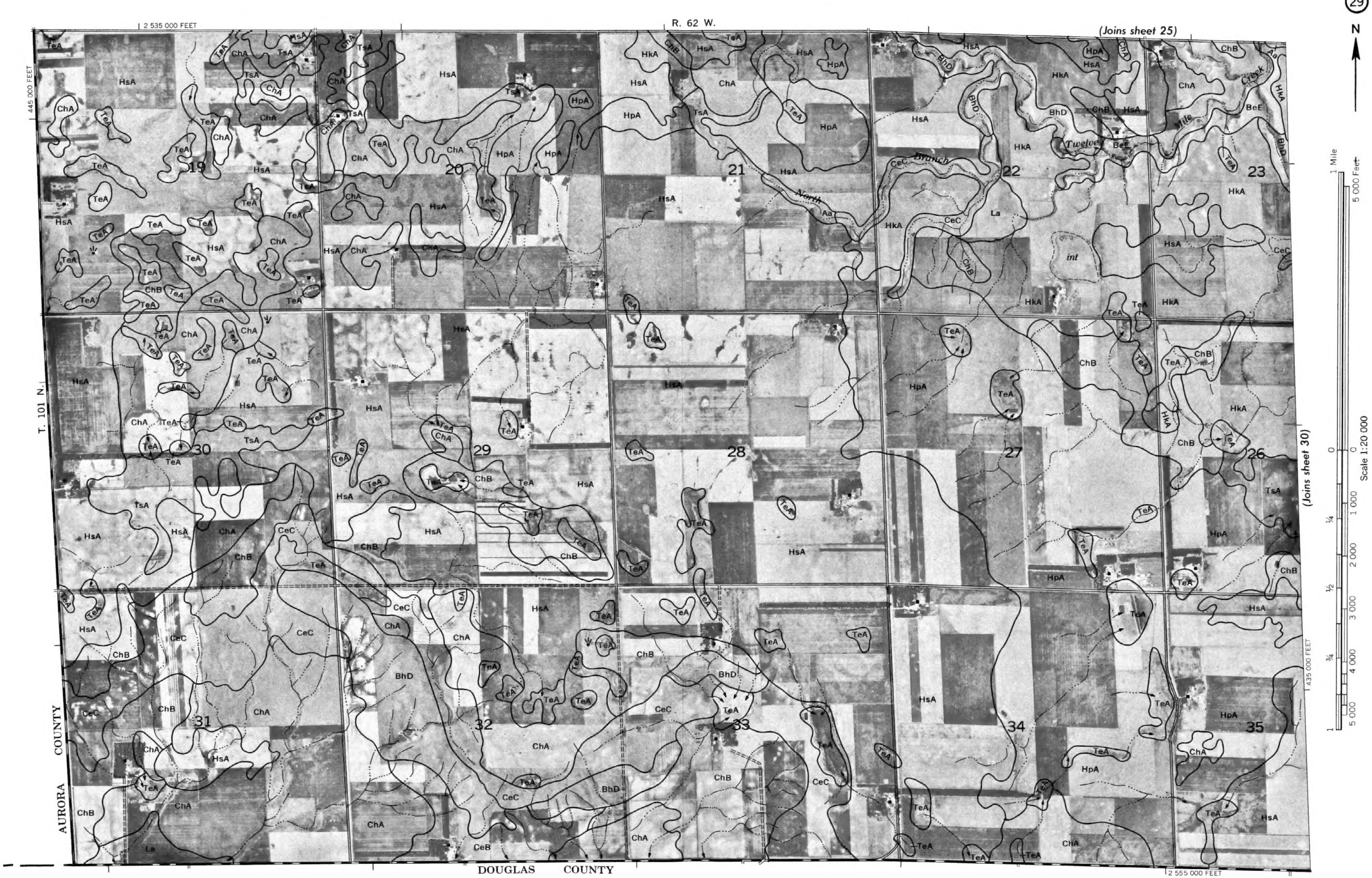
DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 29



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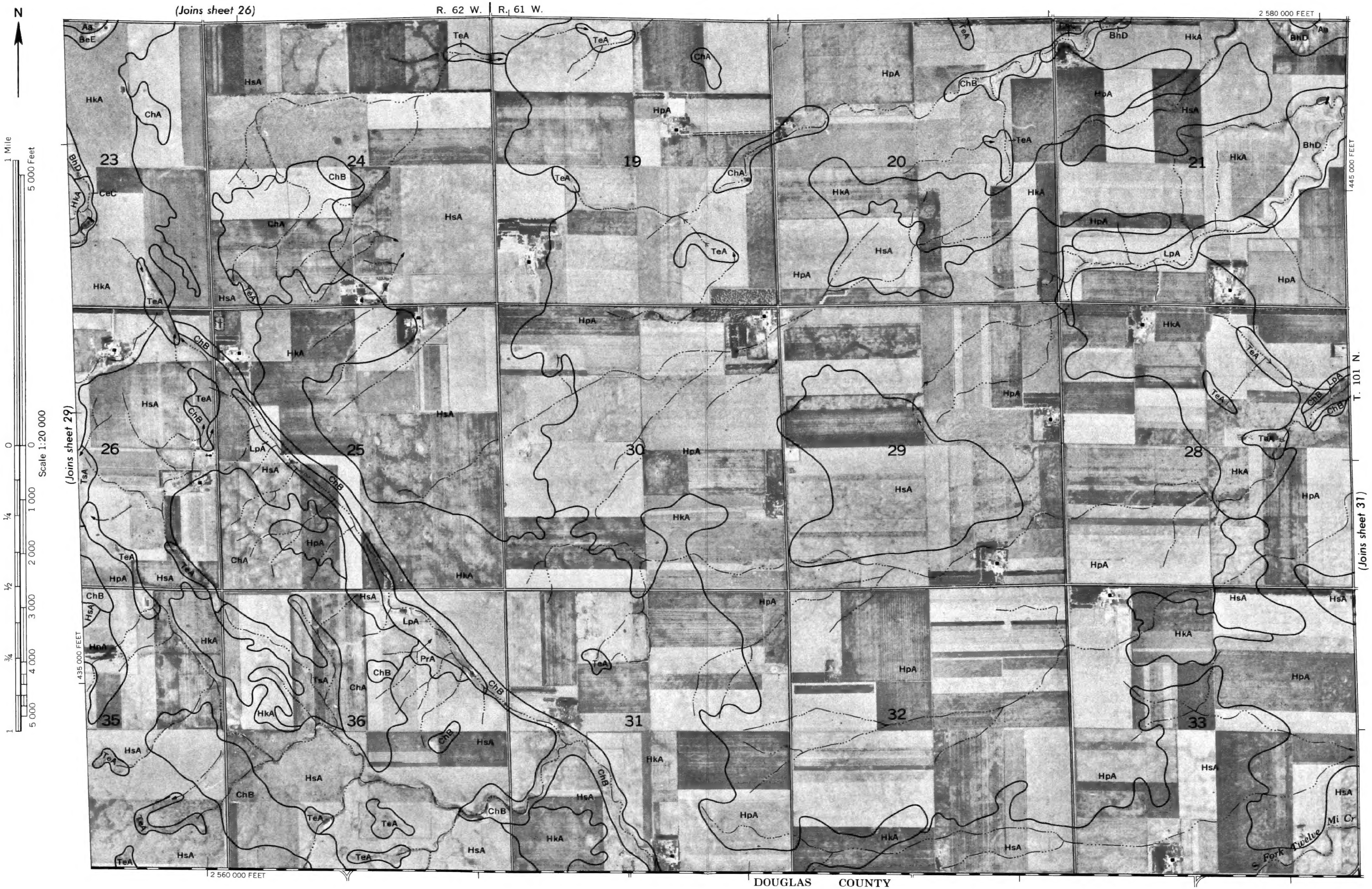
DAVISON COUNTY, SOUTH DAKOTA NO. 29

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 30



DAVISON COUNTY, SOUTH DAKOTA NO. 30

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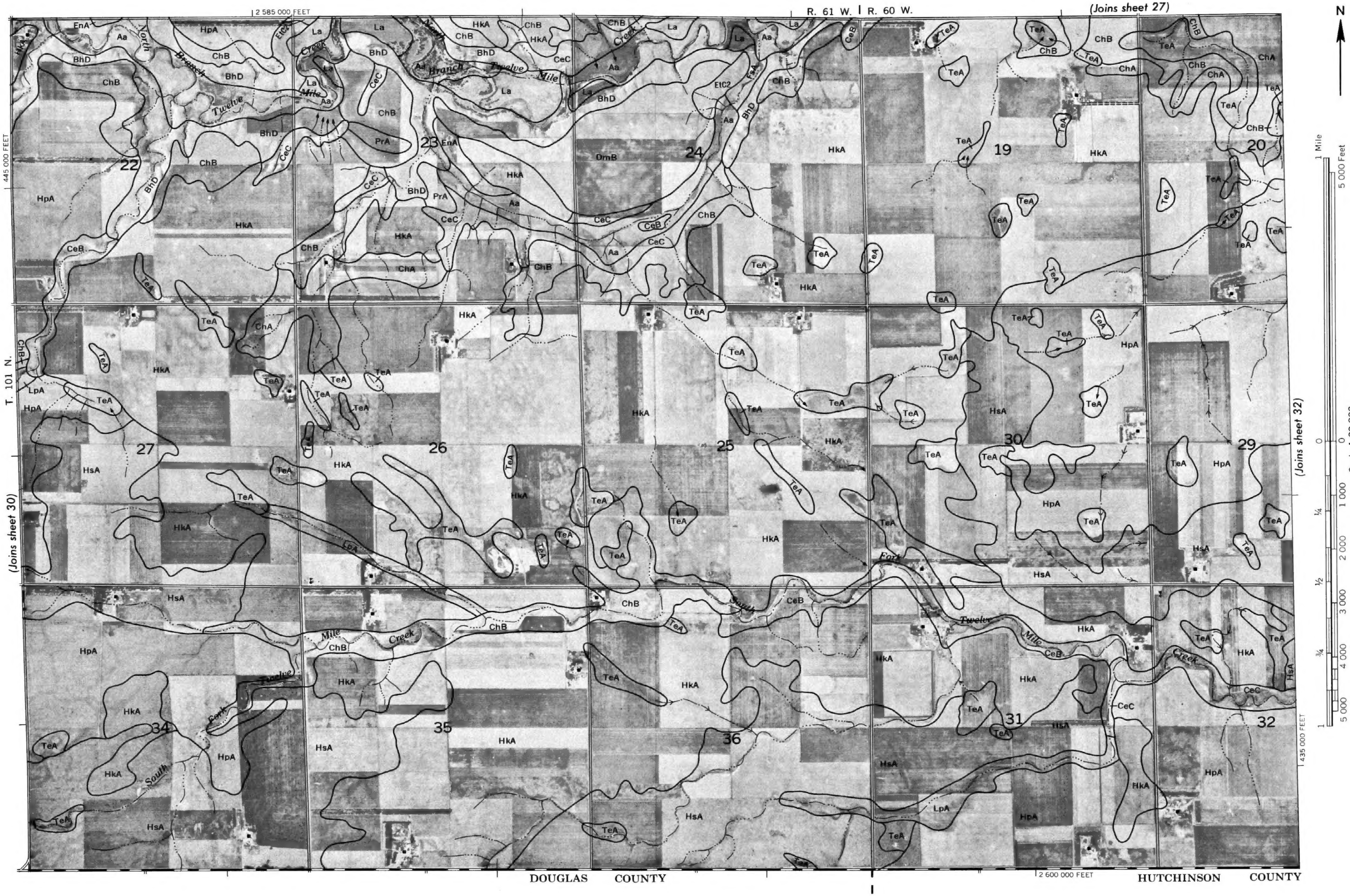

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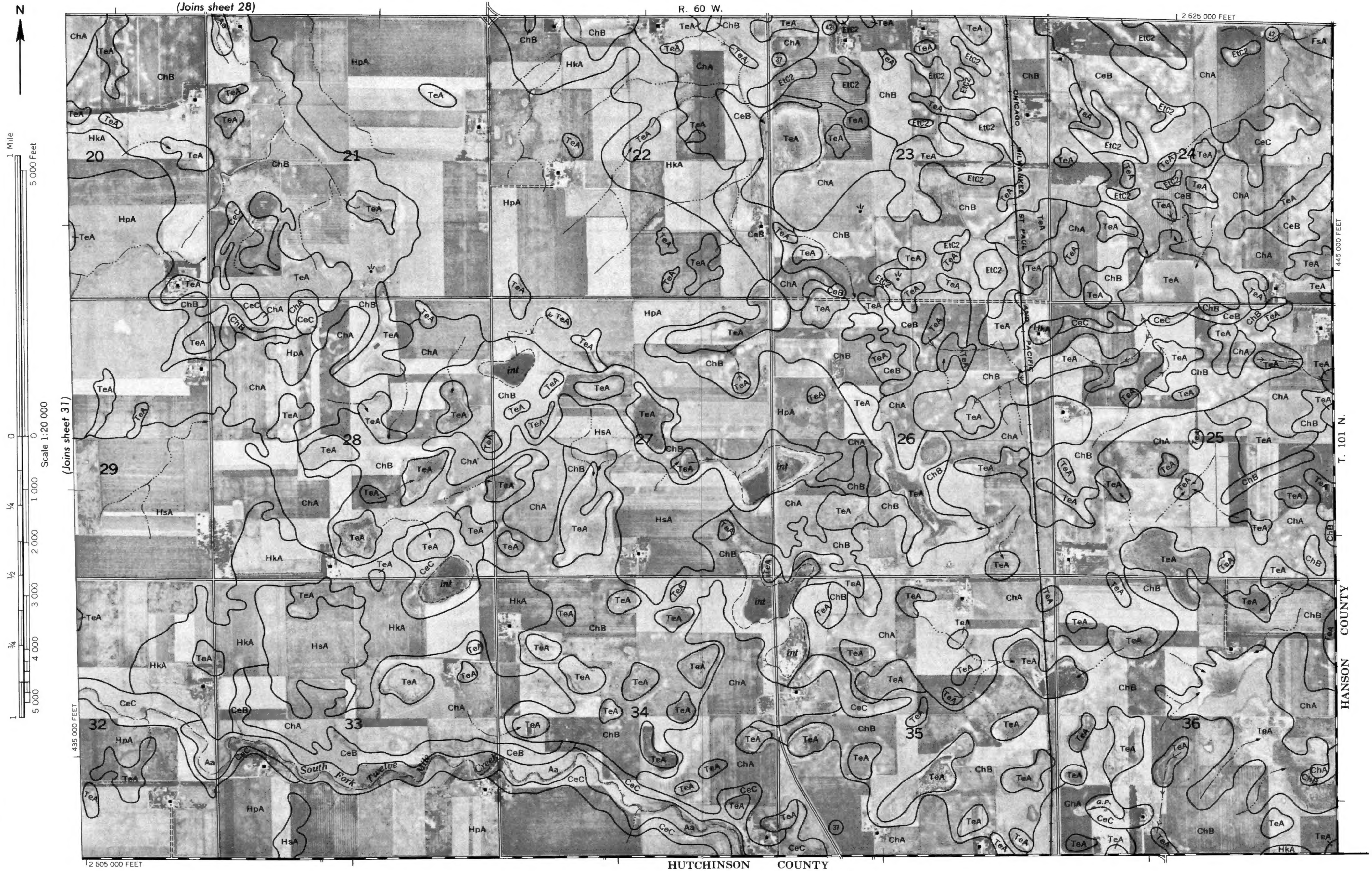
DAVISON COUNTY, SOUTH DAKOTA NO. 31

DAVISON COUNTY, SOUTH DAKOTA — SHEET NUMBER 32



DAVISON COUNTY, SOUTH DAKOTA NO. 32

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